wtc
welding technology corp

MedWeld 4000

Resistance Weld Control

Operator's Guide for Software Programs:

- #T03300 (AC Standard)
- #T03302 (AC w/Ohma Cylinder Support)
- #T03310 (AC - GM WS2)
- #T03311 (AC - GM WS2 / ABB Robot)
- #T02300 (MFDC Standard)
- #T02301 (MFDC Type 1 Inverter)
- #T02302 (MFDC w/Ohma Cylinder & Pressure Control)
- #T02304 (MFDC Multi-Inverter)
- #T02306 (MFDC Multi-Inverter w/Forge)

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Chapter 6   *Stepper Data* *6-1*

Getting Started

If You Need Help . . .

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Welding Technology Corp. (WTC)

WTC is committed to quality products, service and support. Our service department maintains an assistance hotline to assist with application or troubleshooting during normal business hours.

By Phone or Fax:

To arrange for field service, call one of these numbers:

Industrial Technical Service (ITS) **Voice:** **(248) 477-3900**
Fax: **(248) 477-8897**

The ITS telephone number offers 24-hour service, seven days a week. Before calling, make a note of any fault conditions, applicable software and hardware revision numbers. Record the part number of the enclosure (on the serial tag on the inside or front door of the enclosure). Also note the sequence of events leading to the problem, and the drawing numbers of the schematics you received with the enclosure.For your convenience, fill out the "Problem Report Form" on page -xx.

By E-mail:

When an immediate response is not critical, contact WTC at the following e-mail addresses:

welding-sales@weldtechcorp.com **Sales/Marketing Comments**
welding-support@weldtechcorp.com **Technical Support**

WTC's technical support will respond within 24 hours, Monday through Friday, to your e-mail requests. Please include your name, company name, location, product part and serial number and a description of the problem with your request. Be sure to indicate how you want us to respond, and include applicable phone and fax numbers with your e-mail address.

On the Web:

Visit our Web site at: **www.weldtechcorp.com**.

Symbols Used in This Manual

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Danger! and **WARNING!** messages indicate high-voltage hazards in weld controls, SCRs, MFDC inverters and weld monitoring equipment.

Danger!	**This symbol will be used wherever failure to observe safety measures may result in death, severe bodily injury or serious damage to property.**

WARNING!	**This symbol will be used wherever insufficient or lacking compliance with instructions may result in personal injury.**

Caution: and **NOTE:** messages indicate the following:

	Caution: This symbol denotes when insufficient or lacking compliance with the instructions may damage equipment or files.

NOTE: *This convention informs the user about special features, or where to find more information.*

Revision History

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Revision	Release Date	Comments
1	01/0/03	Released as program #T03300-01.
2	06/05/03	Release of preliminary manual for beta test sites.
3	07/14/03	Release of Revision 03 manual reflecting addition of inverter Type 1 and Type 2 functionality.
4	09/15/08	Added other MW4000 softwares for AC and MFDC.

Safety Dangers

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Danger!

FAILURE TO OBSERVE SAFETY MEASURES MAY RESULT IN DEATH, SEVERE BODILY INJURY OR SERIOUS DAMAGE TO PROPERTY.

Danger!

LETHAL voltages are present when applying power to the weld control. Exposure to high voltage WILL CAUSE SEVERE ELECTRICAL BURNS, INTERNAL INJURIES and/or DEATH.

Refer all necessary service on this machine ONLY to qualified maintenance personnel.

Danger!

NEVER drill into the control cabinet without properly protecting internal components from metal debris and removing power. Failure to observe this requirement may cause a potential EXPLOSION HAZARD.

Danger!	**Always ensure proper flow rate, temperature and chemistry of cooling water. Obstructed or insufficient flow of cooling water may damage welding transformers, SCRs or MFDC inverters. Refer to "Cooling Water Requirements" on page -xv for more details.**

Danger!	**NEVER remove circuit boards with 110 VAC (or higher voltage) power applied. Be certain to REMOVE POWER BEFORE servicing, installing or removing circuit boards.**

	Caution: When lifting any weight over 20 kg (~45 lb.), use either a two-man lift or an assisted lift.

How to Use this Manual

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This manual is designed as a reference guide. Use it as you would a dictionary. See the Table of Contents to locate the instructions or information you require. For additional details, you are referred to the appropriate sections and page numbers.

The Table of Contents lists each section and subsection. In these sections, descriptive subheadings indicate the information provided. Simply flip to the page number and subheading indicated.

Detailed procedures describe the steps required to perform each programming task. Other descriptions explain the procedures for installation, initialization and troubleshooting, along with explanations of the hardware and each weld function.

Software Updates

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WTC reserves the right to make substitutions or changes as required to the hardware or software described in this manual.

This manual may be periodically updated to reflect software changes that will affect operation of the equipment described. Request copies of the latest updates by completing the "Comments for Feedback Form" on page -xxii, or by visiting WTC's Web site: **www.weldtechcorp.com**.

Cooling Water Requirements

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Specifications on the Web

The specifications for cooling water are subject to change. For the latest specifications, go to the WTC Web site: **http://www.weldtechcorp.com/documentation/index.html**.

Cooling Water Specifications

The cooling water provided must comply with chemical and physical specifications as stated in the Resistance Welder Manufacturers' Association *Bulletin 5–005.05*:

- Maximum temperature not to exceed 104° F. (40° C.), or fall below the dew point of ambient air at about 70° F. (21° C.).

- Maximum pressure not to exceed 90 PSIG

- pH maintained between 7.0 and 8.0

- Maximum chloride content 20 parts per million (PPM)

- Maximum nitrate content 10 PPM

- Maximum sulfate content 100 PPM

- Maximum suspended solids content 100 PPM, non-abrasive

- Maximum total (suspended and dissolved) solids content 250 PPM

- Maximum calcium carbonate content 250 PPM

- Resistivity less than 2,000 ohms/cm at 25° C. (500 μS)

- The hose used must be NO LESS THAN 18 in. long across the power voltages.

NOTE: *Water that is safe for drinking is generally sufficient for cooling water, provided it is filtered to eliminate sand and rust particles. In addition, water temperature must* NOT *fall more than 2° C. below the temperature of the surrounding air.*

Water Flow Rate

In general, the SCRs require a MINIMUM flow rate of 0.5 gallon (2 liters) per minute. The recommended maximum is 1.0 gal (4 l.) per minute. Larger SCRs (2,100 A. or greater) may require a higher flow rate. Consult WTC for more information.

SCRs with Hose Running Between Tangs at 480 VAC.

The following warning applies ONLY to SCRs which have the water cooling hose running between tangs at 480 VAC (non-isolated).

WARNING!

⚠️

REMOVE POWER from the SCR if the cooling water is not flowing and the resistivity of the water is less than 2,000 ohms/cm @ 25° C, or conductivity is greater than 500 μSiemens @ 25° C.

If water circulation (in hosing between tangs) stops or is interrupted while the power is on, leakage current through the water in the hose between the SCR tangs will cause gas bubbles to form. Current will arc across these voids, weakening or destroying the hose. Putting the water into circulation again develops pressure in the cooling circuit, consequently causing the hose to rupture. ***Therefore, WTC does* NOT *recommend the use of water savers with these SCRs.***

When magnetic contactors are used, they remove power from the SCR module and prevent destruction of the hose. If cooling manifolds are used (rather than hose), leakage current in the water can cause the same destructive action to occur while power is being applied. This can destroy the cement holding the manifold together, resulting in serious water leaks. (WTC's warranty specifically EXCLUDES such failures.)

Hoses

If a cooling hose (for non-isolated SCRs) needs replacing, use a certified non-electrically conductive hose. Its inside diameter must NOT exceed 3/8". The hose between SCR tangs must be *at least* 18 inches long across the power voltages, where the SCR tangs are directly cooled.

Working with Static-Sensitive Devices

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ESD Costs!

Electrostatic discharge (ESD) can ignite flammable materials and damage electronic components. Static electricity can attract contaminants in clean environments or cause products to stick together. Other costs of ESD-damaged electronic devices are in their replacement and production down time. Associated costs of repair and rework, shipping, labor and overhead can be significant. Reducing losses to ESD and static electricity is an ABSOLUTE NECESSITY.

Observe the following warnings AT ALL TIMES:

Danger!

NEVER use the personnel grounding system described below when working with voltages above 220 VAC.

Personnel Grounding

Before touching any Electrostatic Discharge Sensitive (ESDS) devices or circuit boards, put on and wear an Electrostatic Discharge (ESD) wrist strap. Ground this strap through a one megohm (1 MΩ) resistor.

Handling or Moving ESDS Devices

Handle all circuit boards by their edges ONLY. NEVER touch the traces or edge pad connectors.

Transport, store and ship ESDS devices and circuit boards in a static shielding container. An acceptable container is either a static shielding bag or a static shielding tote. To be effective, either type of container MUST be closed.

NOTE:

*Use **ONLY** static-shielding containers for transporting ESDS devices or circuit boards.*

Workstation Requirements

If diagnostics are required, move the circuit board to an approved ESD workstation. A static-safe workstation must include a grounded ESD mat, wrist strap and cord. The measured static voltage at a workstation MUST NOT exceed 50 volts.

Contact Information

For detailed information about ESD precautions, contact

ESD Association
Voice:	315–339–6937	**Web:**	**www.esda.org**
Fax:	315–339–6793	**e-mail:**	info@esda.org

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Patents

· · · · · · · · · · · ·

This product contains intellectual property owned or licensed by WTC, excluding (but not limited to) one or more of the following U. S. patents:

4,388,515	4,399,511	4,459,456	4,459,457	4,463,244	4,973,815
4,493,040	4,513,363	4,516,008	4,721,840	4,733,045	6,130,396
4,804,819	4,831,229	4,849,873	4,851,635	4,885,451	6,215,086
4,973,419	4,945,201	5,128,507	5,276,308	5,347,105	6,225,590
5,386,096	5,424,506	5,440,092	5,449,887	5,471,028	6,342,686
5,483,035	5,589,088	5,667,704	5,757,176	5,793,243	6,359,566

Other patents, U. S. or foreign, may be issued or pending.

The software and documentation associated with this product are protected by copyrights owned by WTC. Trademarks have been adopted and used on all or part of this product.

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Problem Report Form

. . . .

Plant Name and Location: _____

Phone: _____

Your Name: _____ **Date:** _____

 Time: _____

Program # (Timer power-up message): _____–___–____ ___/___/___

Part #: _____

Fault code display. When a fault or error occurs, the <u>Product</u> <u>###</u> displays a status code. Indicate each code that is displayed:

_____

_____

_____

Description of the problem: _____

_____

_____

_____

_____

_____

Sequence of events leading to the problem: _____

_____

_____

_____

_____

_____

Drawing number(s) of schematic(s) shipped with the <u>Product</u> <u>###</u>:

_____

_____

_____

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Your Feedback Welcome Here!

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We welcome your feedback on the accuracy and usefulness of this manual. Our Training and Documentation staff will review your comments and implement the required corrections in future updates.

For specific comments, fill in the Comments for Feedback form below. Fax it at (248) 477-8897.

Comments for Feedback Form

Your Name: _____ **Date:** _____ **Time:** ___

Company Name: _____ **Phone:** _____

Company Address: _____

City: _____ **State:** _____ **ZIP:** _____

Program/Revision #: _____

# of Manuals at your site: _____

Document Number/Name: _____

Your comments: _____

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MedWeld 4000 Overview 1

The MedWeld 4000 is available in following versions:

- A single-phase AC welding control.

- A three-phase Medium-Frequency DC, Type 1 (Medar) inverter control.

- A three-phase Medium-Frequency DC, Type 2 (Common) inverter control.

The control communicates with the welding automation: Either machine controllers, factory automation or manually-operated welders.

Control Description

In the MedWeld 4000, programmed instructions in the software command a timer assembly. The timer assembly controls a weld processor, which issues firing signals to the firing card through a firing cable harness plugged directly into the weld processor. In AC weld controls, signals from the firing card go to a pair of SCRs (silicon-controlled rectifiers). MFDC weld controls, the signals from the timer are passed to the inverter. The SCRs or inverter then output high-voltage, low-amperage current to the welding transformer. Finally, this transformer applies a low voltage at high current to the welding electrodes.

The modular design permits flexible operation in a wide variety of applications. Three forms of communication are possible:

- The *DeviceNet* ™ interface, an open communications standard. It provides a low-cost communications link with I/O messaging between the welding control and tool.

- *Profibus*, an open, digital communication system with many applications, particularly in factory and process automation. *Profibus-DP* is a simple, fast, and cyclic process data exchange between a bus master and the assigned slave device.

- *Discrete Interface* (DIO*)*, where the weld control can exchange I/O with a machine, robot or portable gun controller. In this scheme, inputs (typically running on 24 VDC) and output devices (usually 120 VAC) have their own independent physical connections.

These communication systems add flexibility to the WTC design, providing full-function and programming capabilities. You can program 99 independent weld schedules, then assign a weld schedule to one of 99 independent steppers (to compensate for lost current density).

You can program a weld function to use either Automatic Voltage Compensation (to maintain a desired primary voltage) or Automatic Current Compensation (to maintain constant secondary current).

The MedWeld 4000 can perform the weld, delay, slope, pulsation or timing functions that your application requires. Other features allow control of outputs, and monitor the status of inputs.

Physical Description

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Figure 1 is an internal view of the AC weld control with the door open.

Figure 1: MedWeld 4000 Weld
Control (AC)
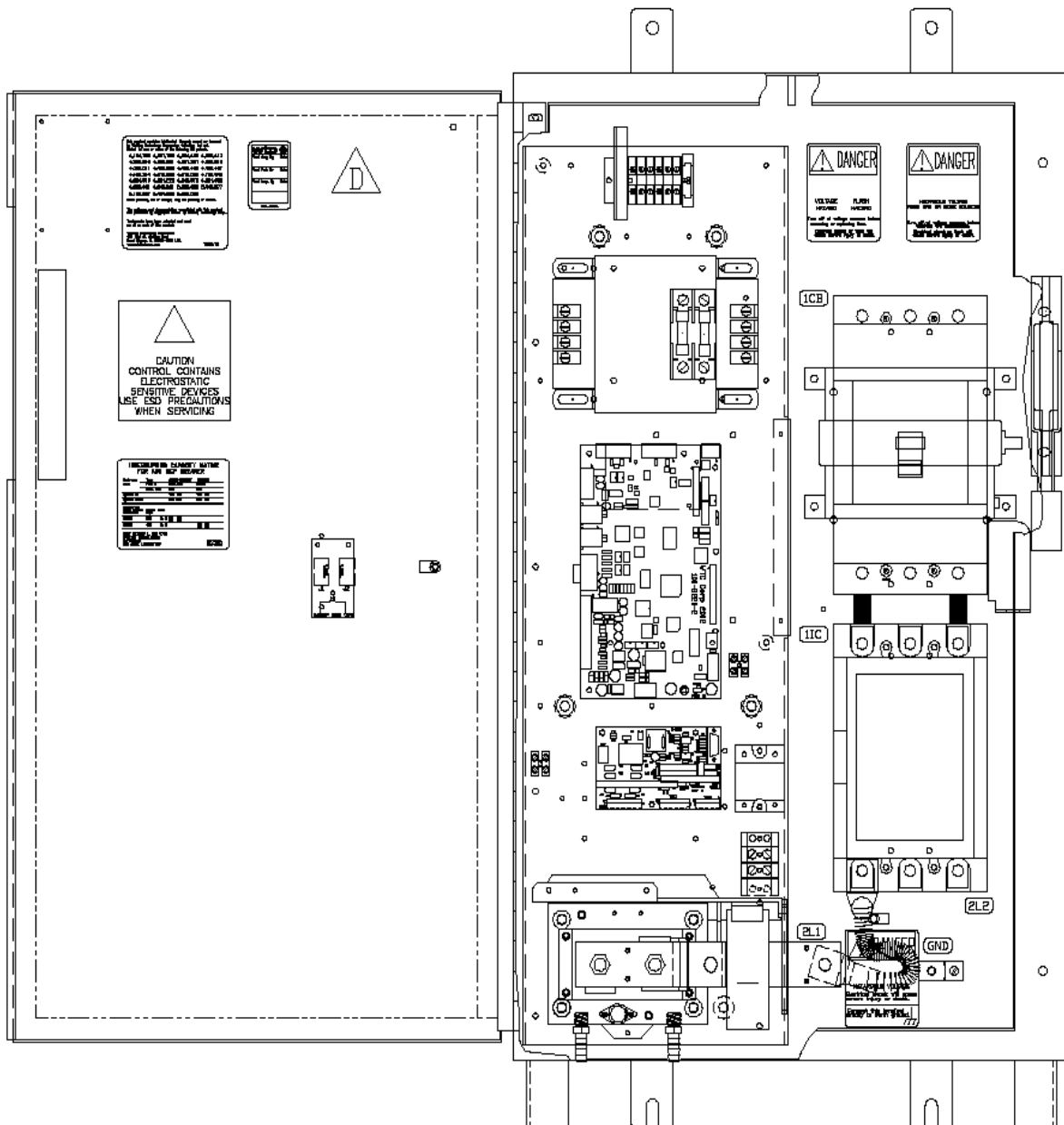
N O T E :   *The possible configuration options are too numerous to detail here.*
Contact your WTC sales representative for assistance on configuration
options.

Type 1 (Medar) MFDC

This following shows an internal view of a typical Type 1 MFDC weld control with the door open. The type 1 inverter is the Medar style of inverter. If you are unsure of the inverter in your control, there will be a label on the inverter that labels it as Medar.
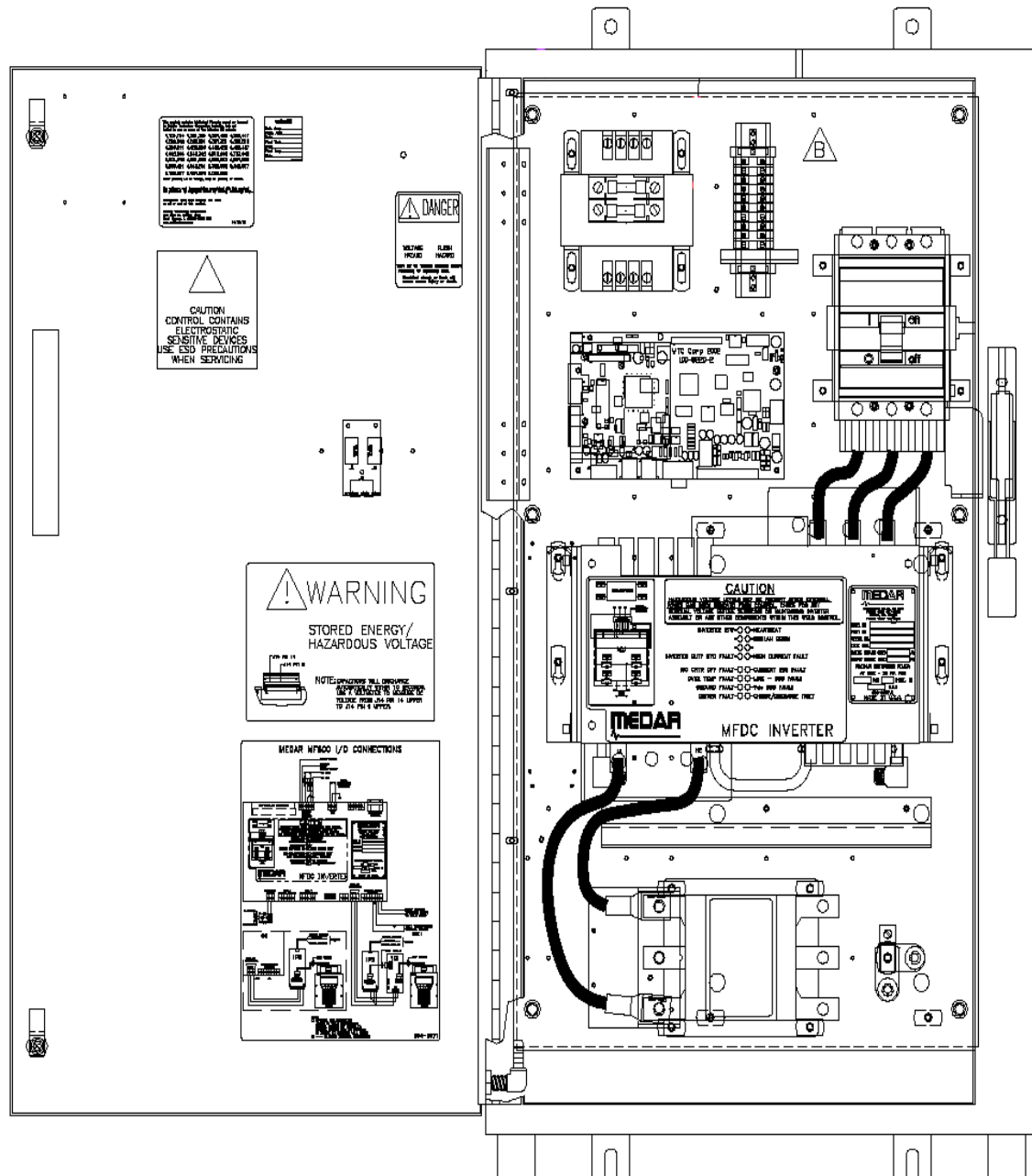
NOTE: *The possible configuration options are too numerous to detail here. Contact your WTC sales representative for assistance on configuration options.*

Type 1 Inverter Specifications

. . . .

This section describes the Type 1 inverter ratings at two output levels:

Type 1 (60 Hz) Inverter 600 Amp

This table lists the electrical ratings for output at 1,200 Hz from 60 Hz mains frequency:

Specification or Quantity		Rating
Minimum mains inductance per line		50 μH
Maximum choke size when adding inductance		50 μH per line
Mains voltage		240–480 VAC (+10%, −15%)
Peak output current		600 A.
RMS current while operating		578 A.
RMS mains line current while operating		535 A.
Power Factor	Nominal	81 %
	KVA Input:	448
	KW Output:	363
Duty Cycle	Maximum Duty Cycle	20%
	Peak output	600 A.
	Maximum Weld Time	0.7 seconds
Cooling Water	Water flow rate	4 liters/minute or 1.06 gal / min
	Water temperature	< 30 °C
Mean Time Between Failures (Mixed Welding and Power-on hours)		
	@ 10 % duty cycle	~ 1,250,000 hrs.
	@ 20 % duty cycle	~ 500,000 hrs.
Operating Life		
	@ 10 % duty cycle	~ 105,000 hrs.
	@ 20 % duty cycle	~ 50,000 hrs.
Cabinet ratings **9 %** duty cycle		
	RMS output current	173 A.
	RMS mains line current	160 A.
Cabinet ratings at **10 %** duty cycle		
	RMS output current	183 A.
	RMS mains line current	169 A.
Cabinet ratings at **20 %** duty cycle		
	RMS output current	258 A.
	RMS mains line current	239 A.

Type 1 (50 Hz) Inverter 600 Amp

The following table lists the electrical ratings for output at 1,000 Hz from 50 Hz mains frequency:

Specification or Quantity		Rating
Minimum mains inductance per line		50 μH
Maximum choke size when adding inductance		50 μH per line
Mains voltage		240–480 VAC (415 VAC nominal) (+10%, −15%)
Peak output current		600 A.
RMS current while operating		585 A.
RMS mains line current while operating		578 A.
Power Factor	Nominal	79 %
	KVA Input:	418
	KW Output:	329
Duty Cycle	Maximum Duty Cycle	20%
	Peak output	600 A.
	Maximum Weld Time	0.7 seconds
Cooling Water	Flow rate	4 liters/minute or 1.06 gal / min
	Water temperature	< 30 °C
Mean Time Between Failures (Mixed Welding and Power-on hours)		
	@ 10 % duty cycle	~ 1,250,000 hrs.
	@ 20 % duty cycle	~ 500,000 hrs.
Operating Life		
	@ 10 % duty cycle	~ 105,000 hrs.
	@ 20 % duty cycle	~ 50,000 hrs.
Cabinet ratings at 50 Hz mains, 1000 Hz output, **10 %** duty cycle		
	RMS output current	185 A.
	RMS mains line current	183 A.
Cabinet ratings at 50 Hz mains, 1000 Hz output, **20 %** duty cycle		
	RMS output current	262 A.
	RMS mains line current	258 A.

Type 2 (Common) MFDC

This following shows an internal view of the Type 2 MFDC weld control with the door open. The type 2 inverter is the common inverter.

Figure 3: MedWeld 4000 Weld Control MFDC Type 2
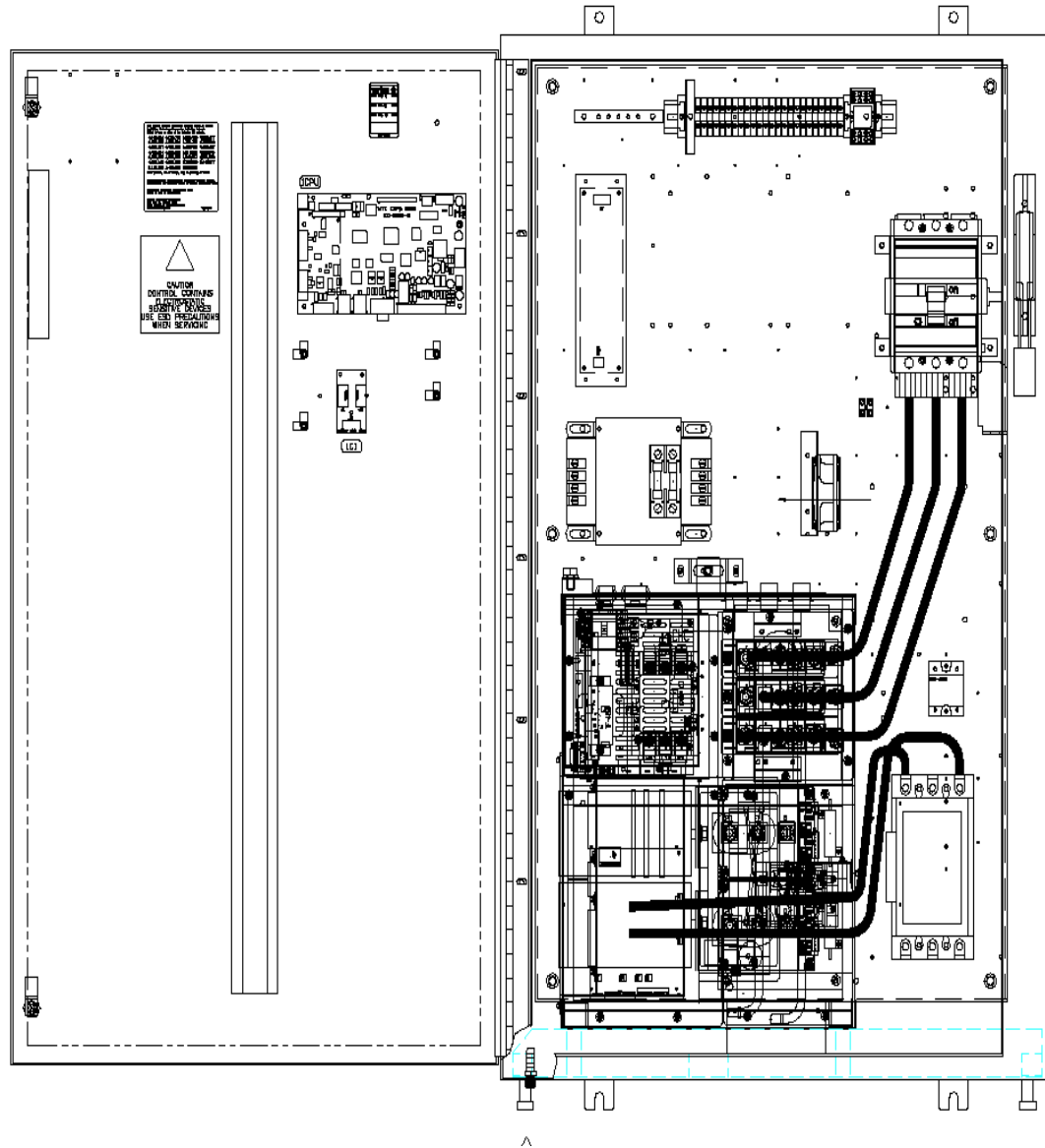
NOTE: *The possible configuration options are too numerous to detail here. Contact your WTC sales representative for assistance on configuration options.*

Component Descriptions

. . . .

This section is a brief description of the following components provided with the MedWeld 4000 control (models):

- Circuit breaker

- Isolation contactor

- Control transformer

- Current coil

- Timer assembly

- Discrete I/O board (optional)

- Firing card

- Cascade Firing Board (optional)

- SCR assembly

- Secondary Current Interface Board (optional).

Circuit Breaker

A circuit breaker provides the means to safely disconnect power from the control in case of a failure, and permits troubleshooting the control safely. Incoming power enters the control enclosure through the access plates at the top right of the cabinet.

The standard control configuration uses a 400 A. circuit breaker. Ratings of 250 A. or 600 A. and higher are optional.

The supply voltage (380, 480 or 600 VAC) is connected to the single-pack breaker at terminals located at the top of the breaker. Refer to "Installation Checklist" on page 2-27 for more information.

An operator handle (on the outside of the cabinet) operates the circuit breaker, and visually indicates its condition. The handle must be UP to turn ON the breaker. The handle must be DOWN to turn the breaker OFF. The middle position indicates that the breaker has tripped.

An operator mechanism interlocks the door with the circuit breaker's status. This mechanism permits turning on the circuit breaker ONLY when the door is closed. Turning the breaker OFF permits opening the door, as a safety feature while servicing the control.

The circuit breaker has a magnetic trip coil and a dial or DIP switches to adjust the level of current the breaker trips at. The magnetic trip coil trips the breaker if instantaneous current reaches or exceeds a pre-set current threshold level.

As supplied from the circuit breaker's manufacturer, the magnetic trip coil is set to its minimum setting. The customer must adjust this setting as the application requires. It is CRITICAL to set this threshold correctly, for these reasons:

•   Setting the magnetic trip to a too-high value can cause the upstream bus fuse to blow before the circuit breaker trips in response to an overload. This means that the fuse needs to be replaced (a time-consuming job) rather than simply resetting the circuit breaker. This is a convenience issue, not a safety issue.

•   Setting the magnetic trip setting too low may cause the circuit breaker to trip under normal welding currents (even if there is no overcurrent fault). This is a nuisance issue, not a safety issue.

Isolation Contactor

The isolation contactor acts to isolate voltage from the weld transformer. It removes power from this transformer's primary circuit. This allows safely servicing the weld electrode tips or weld machine while the control is idle (or when a fault occurs).The timer monitors the state of the isolation contactor via the auxiliary contacts.

The isolation contactor is driven by a single solid-state relay, based on the status of the CONTROL STOP and WELD/NO WELD inputs, and a TURN ON function. Refer to page 4-8 and TURN ON/OFF CONTACTOR SELECT #n (page 4-23) for more information about these functions. Also, refer to the drawing packet of schematics provided with your MedWeld 4000.

Control Transformer

Supply voltage (380, 480 or 600 VAC) from below the circuit breaker goes to a control transformer. It reduces the supply voltage to 120 VAC, and 24 VAC. The 120 VAC is used to pull in the isolation contactor, and to activate the circuit breaker shunt trip. This transformer supplies 24 VAC to power the timer assembly. The timer assembly, in turn, provides optional 24 VDC that can power discrete inputs and outputs.

Current Coils

The standard MedWeld 4000 has a coil to measure primary current. An optional coil measures secondary current.

The primary current coil is the doughnut-shaped device located near the SCR assembly in the control enclosure. It has an iron core.The control uses this device to measure the welder's primary current. Welding current flows through the center of the coil, inducing a current in the coil at the ratio of 200:1. (For example, for every 1,000 A. of primary current, 5 A. flows in the secondary.)

The optional secondary current coil has an air core. It produces current which is proportional to the secondary current's instantaneous rate of change. A Secondary Current Interface Board (Page 1-21) takes this information and determines true current values.

Timer Assembly

The timer assembly (WTC p/n 900-822x-2) provides a firing signal to the firing card, as required by the weld schedule. The firing card then provides the gate signals to the SCRs. The SCRs send welding voltage to the weld transformer, to apply weld current to the work piece.

The timer assembly houses these major components:

• Local I/O and

• An optional FieldBus daughter board.

The following illustrates the connectors on the timer assembly board:

Figure 4: Timer Assembly Board Connectors

MedLAN communications LED

Normal / Program I/O jumper

MedLAN port

J2

WTC Corp 2002

900-822x-2

Analog 2 channel

J4

Analog 1 channel

J5

A B   C D E

J8   J6 (#1)   J7 (#2)   J9   J10

5-position Phoenix connector

Connectors to Discrete I/O Boards

Connector to Firing Card

Power and Local I/O connector

Status LEDs (behind J10):
A: Shunt Trip output
B: Isolation contactor output
C: Isolation contactor status
D: Thermal switch
E: Control Stop

The timer assembly provides five connectors for system communications:

- **Local DEP port J8:** Connect a DEP-100S Data Entry Panel to port **J8** to program the control's basic operating parameters and to set its network address. This connector requires using the door/remote I/O interface kit (WTC p/n 830-0654).

- **MedLAN port J2:** Use connector **J2** to link the weld control to other controls and a network monitoring system through the Local Area Network (**MedLAN**).

- **Firing Card port J9:** This connector links the timer assembly board to the firing card.

- **Ports J6, J7:** These connectors link the timer assembly to communicate with up to two Discrete I/O boards.

The weld processor performs the following weld timing functions required to execute a weld schedule:

- Checks input signals (provided through the Discrete I/O board) from the I/O modules (either FieldBus or Local I/O) and responds to them accordingly.

- Operates the signals (through the Discrete I/O board) based on the weld schedule.

- Sends firing signals to the firing card as required by the weld schedule.

- Receives sense signals for line voltage, current and power factor from the firing card.

- Adjusts the firing signal, based on the power factor and the line voltage or primary current, based on how the weld schedule is programmed.

LED indicators on the weld processor module show control status.

FieldBus Daughter Board

The FieldBus daughter board is part of the timer assembly. Depending on its design, this board implements either of the following interfaces:

- *Profibus* or

- *DeviceNet* DP.

Refer to the diagram below. It illustrates the connectors, status LEDs and DIP switches for the FieldBus daughter board, as configured for Profibus communications:

Figure 5: FieldBus Daughter
Board (Profibus)
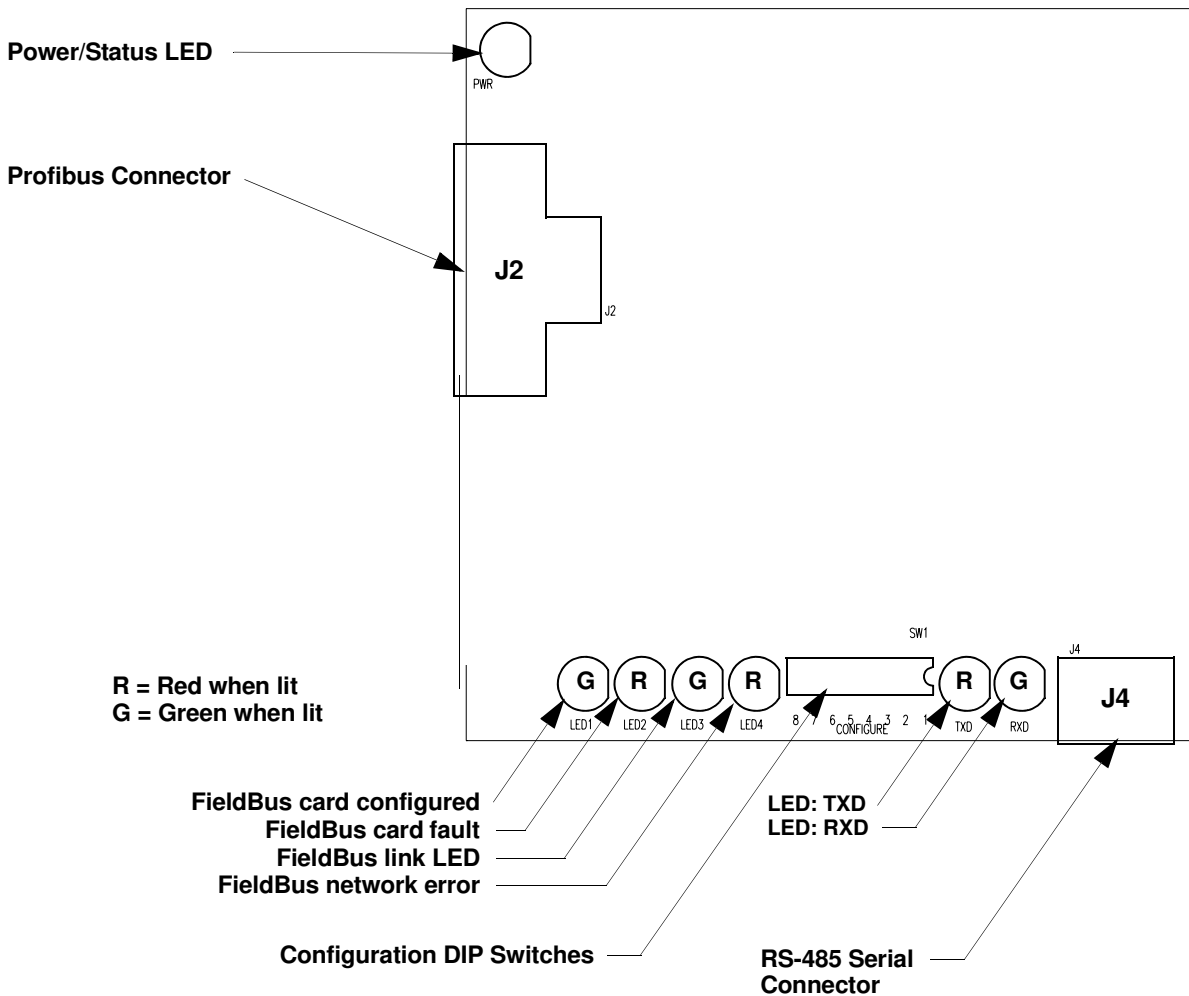
Power/Status LED

Profibus Connector

**R = Red when lit
G = Green when lit**

FieldBus card configured
FieldBus card fault
FieldBus link LED
FieldBus network error

LED: TXD
LED: RXD

Configuration DIP Switches

**RS-485 Serial
Connector**

After installing the control and before putting it into service, it is necessary to correctly set the baud rate and node address for this board. For more details, refer to "Configuring the FieldBus Daughter Board" on page 1-14.

NOTE: Profibus configuration switches set only the local station address value using binary coded decimal (BCD) on the dip switches.

This diagram illustrates the connectors, status LEDs and DIP switches for the FieldBus daughter board, as configured for the DeviceNet (FieldBus) communications:

Figure 6: FieldBus Daughter Board (DeviceNet)
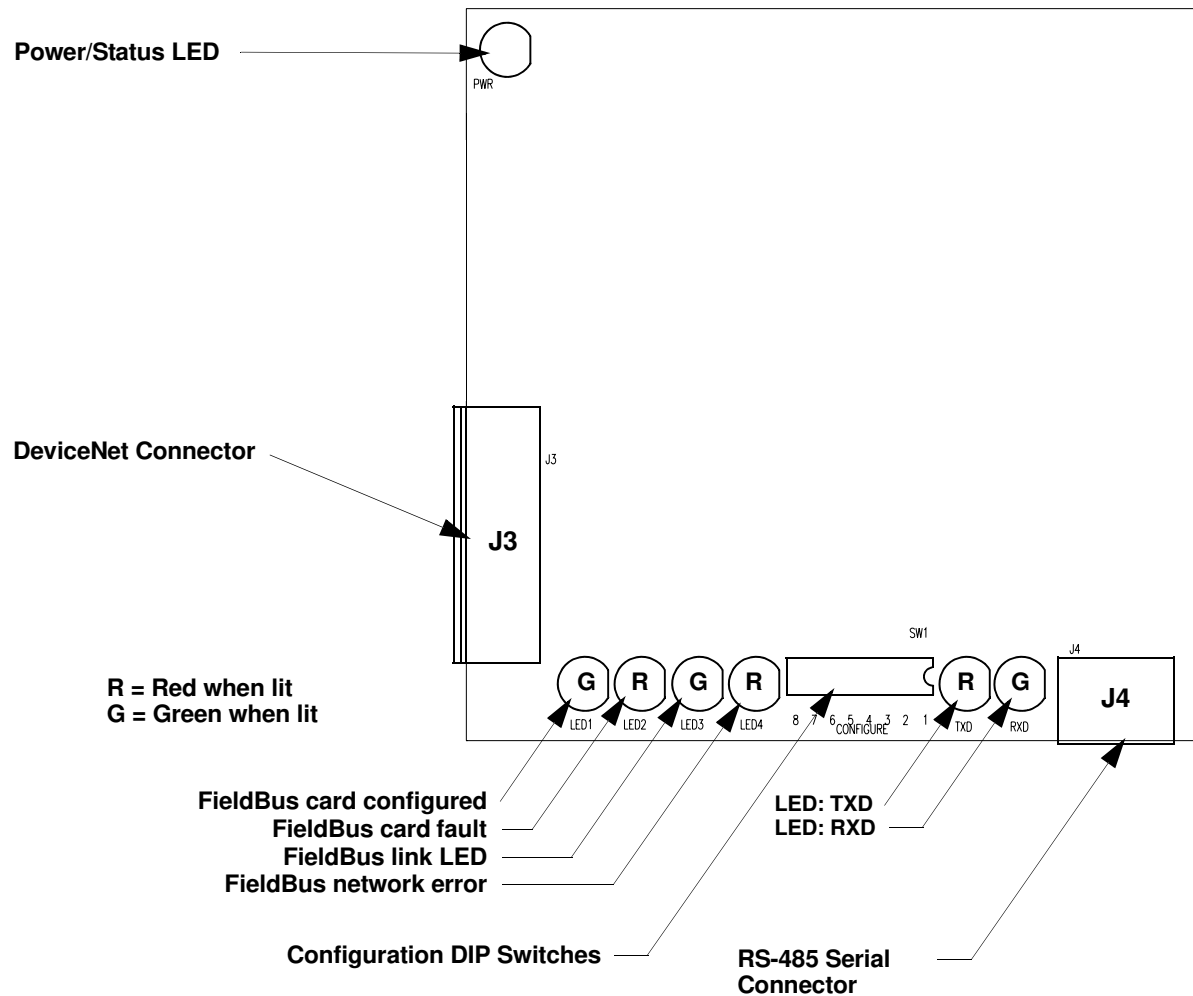
Power/Status LED

PWR

DeviceNet Connector

J3

J3

R = Red when lit
G = Green when lit

SW1

G R G R R G

J4

LED1 LED2 LED3 LED4 8 7 6 5 4 3 2 1 TXD RXD **J4**
CONFIGURE

FieldBus card configured
FieldBus card fault
FieldBus link LED
FieldBus network error

LED: TXD
LED: RXD

Configuration DIP Switches

RS-485 Serial Connector

After installing the control and before putting it into service, it is necessary to correctly set the baud rate and node address for this board. For more details, refer to "Configuring the FieldBus Daughter Board" on page 1-14.

Configuring the FieldBus Daughter Board

LEDs indicate operating status of the FieldBus daughter board, and status of its connection to the network. Refer to the following tables.

Module Status LEDs

Bit	State	Function
–	OFF	Device not powered.
LED1	Green	Device is operational.
	Flashing Green	Configuration is missing or incorrect: Device requires commissioning.
LED2	Red	Unrecoverable fault.
	Flashing Red	Minor (recoverable) fault.

Network Status LEDs

Bit	State	Function
—	OFF	Device not powered / not on-line.
LED3	Green	Link is OK; On-line; Connected.
	Blinks Green	On-line but not connected.
LED4	Red	Critical link failure.
	Blinks Red	Connection timeout.
LED3/4	Blinks Green / Red	A specific communication faulted device. The device has detected a Network Access error and is in the Communication Faulted state. The device subsequently received and accepted an identity Communication Faulted Request - Long Protocol message.
TXD LED	Blinks red during configuration/ communications.	The control is either communicating to the optional daughter board serial port, or FieldBus configuration is occurring.
RXD LED	Blinks green during configuration/ communications.	The control is receiving data from the optional daughter board serial port, or FieldBus configuration is occurring.

After installation and before beginning operation, DIP switches on the communications daughter board must be correctly set. Refer to the next section and the following tables for more information.

NOTE: The DIP switch settings apply when configuring both the DeviceNet and Profibus systems, and for both rocker and slider switches:

Rocker: *Slider:*

• ON (closed) sets the bit to a **0**.

→ ON → ON

• OFF (open) sets the bit to a **1**.

Configuration Switches

You can configure the baud rate and node address for the module via DIP switch SW1. Configure as follows:

- **Node Address:** Use the 6 least significant switches to set the node address. Valid range of settings is **0 - 63** for DeviceNet, **0 - 126** for Profibus. Set Switch **6 ➤ 1**.

- **Baud Rate:** Set the baud rate using the two most significant switches, 8 and 7. The valid settings are

  - **00** = 125 kb/sec

  - **01** = 250 kb/sec

  - **10** = 500 kb/sec

Refer to this diagram for proper switch orientation.

ON

8 7 6 5 4 3 2 1

Baud rate
(MSB - LSB)

MAC ID
(MSB - LSB)
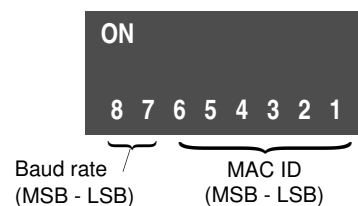
Switches (Fieldbus Specific Input Register)

Node Address: Set the node address for the MedWeld 4000, in the range **0 - 126**. A 7-pole binary switch specifies the address. Refer to the following table:

Switch #7	#6	#5	#4	#3	#2	#1	Node Address
Bit 6 (MSB)	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)	
0	0	0	0	0	0	0	0
0	0	1	0	0	0	1	1
0	0	0	0	0	1	0	2
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
0	1	1	1	1	0	1	61
0	1	1	1	1	1	0	62
0	1	1	1	1	1	1	63
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
1	1	1	1	1	0	0	124
1	1	1	1	1	0	1	125
1	1	1	1	1	1	0	126

Discrete I/O Board

The Discrete I/O board (WTC p/n 900-8213-2) serves to add more I/O capability to the welding control. The board's main features are:

• 16 inputs (grouped in 2 banks of 8 inputs per bank. Each bank can operate at a different voltage). These inputs can operate with any voltage between 16 V and 120 VAC or VDC.

• 10 outputs (grouped in 2 banks of 5 outputs per bank. Each bank can operate at a different voltage.) The outputs are electromechanical relays rated to switch up to 5 A. at 240 VAC.

This board operates at either 50 or 60 Hz line frequency.

Figure 7 below shows the connectors and LEDs on the board:

Figure 7: Discrete I/O Board Connectors and LEDs

Connector to Timer Assembly Board

Power LED

900-8213-2 WTC Corp

J2

Output LEDs 1, 3, 5, 7

#1 #3 #5 #7

#2 #4 #6 #8 #9 #10

Output LEDs 2, 4, 6, 8, 9, 10

Input LEDs
Left to right:
#1 - 16. (Red = input is ON.)
2 banks of 8 inputs per bank.

1 2 3 4 5 6 7 8   9 10 11 12 13 14 15 16

J3   **J4**   **J5**

8 Inputs
(110 VAC/
24 VAC / VDC

(**J3**, **J4**: 2 banks of 8 inputs each)

8 Inputs
(110 VAC/
24 VAC / VDC)

10 Outputs
(dry contacts,
2 banks of 5 outputs per bank)

Input Voltage Level LEDs
(Green = 24 VDC;
OFF = 120 VAC)

In the standard configuration, the inputs operate on 24 VDC. Power to activate the inputs is supplied from the Discrete I/O board.

However, with voltage from an external supply, any voltage between 16 VDC and 180 VDC, or 16 VAC and 120 VAC, can activate the inputs. No jumpers or user setup are required. The Discrete I/O board adjusts itself automatically to the correct operating voltage.

The ten outputs are electromechanical relay contacts with a current rating of 5 A. at 30 VDC, 120 VAC or 250 VAC. Eight relay outputs are normally-open, closed when activated. The other two outputs are SPDT. Either normally-open or normally-closed contacts can be used.

The connection between the Discrete I/O board and the weld timer is via a standard 8-pin modular connector, similar to a Category 5 Ethernet connector. A standard Category 5 cable can connect the I/O board to the timer. The timer supplies all power for the circuitry on the board. A maximum cable length of 8 m (~25 feet) can be used.

The Discrete I/O board "intelligently" measures the voltages at the input pins and adjusts the load resistances and logic thresholds to accommodate the detected voltages. Any input voltage less than 140 VAC or 180 VDC will not damage he board. A minimum 16 VAC or 15 VDC (either polarity) is required to activate an input. An input will not be activated by any current of less than 2 mA., regardless of nominal input voltage. Recommended nominal input voltages are 24 VAC, 24 VDC or 120 VAC.

A light emitting diode (LED) indicates the status of each input. If an input is ON, the LED lights brightly. If the input is OFF, the LED glows very dimly or it will be OFF. A dim or OFF LED means that some small amount of current is being applied to the input. If driving the inputs by 120 VAC from the solid-state outputs of a programmable controller, some leakage current through the outputs can be expected. If the voltage applied to the Discrete I/O board inputs is below 10 VAC, they will not be activated.

If a DC voltage is used to activate an input, the LED for that input lights red if the voltage is positive relative to the input common, or green if the voltage is negative relative to the input common. If using AC to activate an input, the associated LED will glow yellow-orange.

For each group of inputs, a green LED indicates which voltage level the inputs are operating on. If the inputs are in low-voltage mode (24 V AC/DC nominal), this LED will light. If the inputs are in high-voltage mode (120 V AC/DC nominal), this LED will be OFF. On power-up, the green LED will light (24 V mode) until a high-voltage signal is applied to any input.

DC Operation

When operating on 24 VDC nominal, the inputs are guaranteed to activate at any voltage above 14 VDC (with a current draw of ~7 mA.). They are guaranteed to not activate at any voltage below 5 VDC (current draw at 2 mA.). An input can tolerate up to 40 VDC continuously. An input will not be damaged by up to 30 VAC continuous, or by negative voltages up to 40 VDC.

Connector J3 provides 24 VDC power to activate the inputs. Pin 1 is +24 VDC. Pins 11 and 12 are the negative terminal of the 24 VDC power. This power source is protected with a 0.5 A. fuse.

AC Operation

No changes to any components on the circuit board are necessary to support AC input voltages between 16 VAC and 36 VAC, or between 85 VAC and 140 VAC. You can activate the inputs by applying external AC to the desired input terminal.

NOTE: *When using external power, the internal 24 VDC initiate power source* MUST *be disconnected.*

Within each group of 8 inputs, the initiate voltage must be the same for the entire group. It is possible to operate one group of inputs at 120 VAC and the other at 24 VDC.

When operating at 24 VAC, the minimum voltage at which an input is guaranteed to activate is 16 VAC, 50 or 60 Hz. The maximum voltage guaranteed to NOT activate an input is 5 VAC, 50 or 60 Hz. At 24 VAC, the current draw of the input is ~12 mA.

At voltages between 85 and 140 VAC, the minimum voltage at which an input is guaranteed to activate is 80 VAC, 50 or 60 Hz. The maximum voltage guaranteed to NOT activate an input is 20 VAC, 50 or 60 Hz. At 120 VAC, the input draws ~12 mA current. At 20 VAC, an input draws ~1 mA. If an input is driven by a solid-state relay output with a leakage current of 2 mA. OR LESS, the leakage current will not activate the input.

When operating with an AC input signal, the response time of an input to recognize a valid signal is 10 msec.

The inputs are isolated from ground and can be operated from an ungrounded power source. Each group of 8 inputs is isolated from the other group of 8 inputs so it is possible to operate one group of inputs from a grounded 24 VDC power source and the other from an ungrounded 120 VAC power source.

When operating the inputs with an external power source, nothing should be connected to the +24 VDC power source on the input connector.

Inputs

The 16 inputs are divided into two groups of 8. Group 1 inputs are on a 12-pin Phoenix connector labeled **J3**. Group 2 inputs are on a 10-pin Phoenix connector, **J4**. To find the connectors' pinouts and wiring information, refer to the schematics supplied with the control.

To activate an input, either 24 VDC, 24 VAC or 120 VAC is applied between the input and its common. Activating an input sets the corresponding bit as **1**. If an input is not activated, the corresponding bit is **0**.

Outputs

The ten outputs of the Discrete I/O board are electromechanical relays, rated to switch up to 5 A. at 120 VAC or 2 A. at 250 VAC. A 17-position Phoenix-type pluggable connector labeled **J5** is used for the output signals.

Eight outputs are SPST (normally-open only), arranged in two groups of four. The two SPDT relays are separate. Each group of four relays has a single common connection. The other two relays have all three poles brought out separately so they can be connected in a normally-open or normally-closed configuration, independent of the other 8 relays. The timer's software determines which output is used for which purpose.

The Discrete I/O board provides no fuses for any of the outputs.

The response time of the relays is 15 msec. maximum to activate or de-activate.

All the relays come out on a 17-pin Phoenix connector. For the pinouts of this connector and wiring information, refer to the schematics supplied with the control.

Firing Card

The firing card performs the following tasks:

- Provides sense signals to the processor to provide voltage, current and power factor reading, as well as properly regulating the SCRs,

- Provides gate signals to turn on the SCRs,

- Inputs and outputs all of the control's current monitoring and

- Performs high-voltage sensing.

Firing Card Input Signals

The wires connected to the firing card connector J3 (1L1 and 1L2 *without* an isolation contactor, or 1L1, 1L2 and 2L2 *with* an isolation contactor) originate across the 380/480/600 VAC supply voltage. These wires carry the zero-crossing logic signal. This signal synchronizes the weld processor with the supply.

They also provide the voltage-to-frequency logic signal that the weld processor card uses to measure line voltage.

The current coil generates a voltage signal which is proportional to the measured current. This signal enters the firing card *via* connector J4. The signal is converted to the current-to-frequency logic signal, which the weld processor board uses to measure the welder's current.

The firing card receives a logic-level firing signal through its J2 connector from the weld processor card. This signal is optically coupled to a high-voltage circuit on the firing card, and controls the SCR wired through the firing card connector J1.

Firing Card Output Signals

The firing card also outputs a group of logic level signals from the various connections at the welder's primary circuit. The weld processor uses these signals to:

- Find the zero-degree phase angle point on the supply power as a reference for its phase-angle measurements

- Measure the line voltage, current and power factor

- Adjust the firing phase angle, based on the voltage or current (depending on the firing mode) and the power factor and

- Check for shorted or misfiring SCR(s).

All of these signals are transmitted over firing card connector J2 and weld processor card connector J3.

Cascade Firing Board

The MedWeld 4000 can switch multiple contactors with one weld timer, a firing board and a system of relays. The *Cascade Firing Board* (CFB) implements this capability.

The CFB controls a system of three relays. They switch the gate lead connections between each firing board and three SCR pairs. This "pass-through" configuration of relays prevents the possibility of firing more than one SCR at a time (which can cause catastrophic failure).

The CFB is the same size as a 645 firing board, and uses the same mounting centers. The interface has four connectors to receive inputs to the SCR gate leads. Three output signal connectors go to the SCR gate leads. Three red LEDs indicate activation (if any) of its respective SCR.

Depending on which version is ordered, the CFB operates on either 120 VAC or 24 VDC.

SCR Assembly

When the SCR signal is gated in a single-pack configuration, power is passed to the weld transformer through connector H1. (Refer to the drawings supplied with your control for more information.)

Single-pack controls use a pair of SCRs. The unit has internal water cooling to minimize the external water connections.

Secondary Current Interface Board

This section describes the Secondary Current Interface Board (abbreviated to SCIB). The SCIB is an add-on accessory to kernel-based welding controls (i. e., MedWeld 4000, 200, etc.). The SCIB enables the welding control to read secondary current.

The SCIB installs in-line on the cable which connects between the weld timer and the firing board. The form factor of the SCIB includes mounting holes which match those on the firing board.

The SCIB uses an air-wound (Rowgowski) current-sensing coil to measure secondary welding current. This sensing coil connects to the SCIB via a 2-pin Phoenix connector.

The SCIB is designed for use with air-core current sensing coils which meet the IEC standard of 150 mV output per kA with a sinusoidal 50 Hz current waveform (0.477 µHy mutual inductance). On 60 Hz, these coils output 180 mV per kA. To allow for variance in current-sensing coils, the welding control has a setup parameter to allow setting the mutual inductance between 0.05 and 0.99 µHy. The SCIB secondary current coil input terminals present a 1,000-ohm load to the coil. For more details on programming this parameter, see page 5-16.

The SCIB can measure AC or DC currents up to 100,000 A. For AC currents greater than 25% of full-scale, the measurement uncertainty of the SCIB itself is 1% of reading, plus the measurement uncertainty of the current-sensing coil.

For DC currents greater than 25% of full-scale, of less than 0.5 sec duration, the measurement uncertainty of the SCIB itself is 2% of reading, plus the measurement uncertainty of the current-sensing coil. Once installed and with self-calibration at recommended intervals, repeatability of the current reading from the SCIB is within +1 %.

The SCIB has three current ranges which are set with suitcase-type jumpers on the circuit board. These ranges are 0–25 kA., 0–50 kA. and 0–100 kA. Higher currents, up to any desired value, can be obtained by using a special jumper setting together with an external resistor network on the current-sensing coils.

MFDC Control Description

. . . .

The MedWeld 4000 uses a *Medium Frequency DC Inverter* (MFDC) with two different options:

- A Type 1 (Medar) inverter, using software T02300.

- A Type 2 (Common) inverter, using software T02300.

The MFDC replaces the standard silicon-controlled rectifiers (SCR packs) to perform the power conversion required to weld at frequencies from 400–2,000 Hz.

Advanced options provide added flexibility to the WTC design, which provides full-function and programming capabilities. You can program 99 independent weld schedules, then assign a weld schedule to one of 99 independent steppers (to compensate for decline in current density due to mushrooming or alloying of the electrodes).

The control compensates for changes in the welding environment by monitoring the voltage and increasing the current as required to ensure consistent welds. The primary current (I) changes as the voltage fluctuates. (For example, if the weld energy (E) drops, the processor firing phase shifts forward (to increase I) until E stabilizes.)

You program a weld function specifying current in two ways:

- To use either Automatic Voltage Compensation (to maintain a desired primary voltage) or

- Automatic Current Compensation (to maintain constant secondary current).

The MedWeld 4000 can perform the weld, delay, slope, pulsation or timing functions required by your application. Other functions allow you to control outputs and monitor the status of inputs.

Weld Processor Interface to the Inverter

The interface between the weld processor and the MFDC inverter has three functions:

- It allows the processor to specify the amount of current to the work piece,

- It allows the inverter to alert the processor of fault conditions it detects during the weld and

- Provides weld data to the processor.

The inverter responds to the single-phase timing firing signals from the weld processor. The weld processor tells the inverter when to pull in the main isolation contactor and receives the signal from the inverter when

the inverter is ready to weld. (This interaction with the weld processor is described in greater detail in "MFDC Control Component Descriptions" on page 1-24.)

Weld Processor Output

The weld processor activates the TURN ON ISOLATION CONTACTOR output to the inverter when it executes Function #52 in the weld schedule. This output is NOT directly wired to the isolation contactor: It sends a signal to the inverter that the contactor should be pulled in. (The inverter's regulator board receives the signal. The regulator board is wired to the isolation contactor.)

Weld Processor Input

The weld processor receives the ISOLATION CONTACTOR input directly from the isolation contactor. This input indicates the status of the contactor (pulled in or dropped out).

The weld processor also receives a Ready to Weld signal from the inverter (IRTW). This indicates when the inverter is capable of providing weld current:

- The inverter thermal switches indicate that cooling water is present.

- The isolation contactor can be pulled in.

- The inverter capacitors are ready for charging (to provide DC bus voltage).

Communications

The two devices also share the MedLAN serial communications link, where the weld processor acts as the master device and the inverter serves as a slave device. (The inverter CANNOT initiate any communication. It can only respond to requests for data.)

After each weld sequence, the weld processor instructs the inverter to upload the weld summary, including any fault conditions and weld data.

MFDC Control Component Descriptions

. . . .

The MedWeld 4000 MFDC control has the following components:

- Circuit breaker (page 1-8)

- Isolation contactor (page 1-9)

- Charging pack (Type 1 inverter only; see page 1-24) ,

- Control transformer (page 1-9)

- MFDC inverter (page 1-25) and

- Weld processor (page 1-26).

Charging Pack

The charging pack is used to prevent damage to the inverter by controlling the inrush of incoming power to the inverter's charging capacitors.

Once the charging pack is activated, it remains activated until either an inverter fault is generated, the charge request signal is deactivated (Control Stop lost, ISOLATION CONTACTOR output deactivated on an MF600 (without an isolation contactor after the inverter), or power is removed from the MedWeld 4000).

If the inverter has discharged just before it is requested to close, the inverter may delay activating the charging pack for up to 20 seconds.

The charging pack is external to the Type 1 inverter. The Type 2 inverter includes the charging pack internally

For Type 1 (Medar) inverters, the charging pack will vary according to the size of inverter:

- **Medar MF300:** The charging pack for the MF300 inverter is a three-phase half-wave bridge rectifier. The rectifier module is integrated into the MF300 inverter.

- **Medar MF600:** The charging pack for the MF600 consists of the charging contactor and the mains contactor. The inverter controls the operation of the charging contactor and the mains contactor. The charging contactor is activated first (it charges the inverter's capacitors through resistors). The inverter then closes the mains contactor after the voltage has stabilized. The mains contactor bypasses the charging resistors when it is pulled in. The mains contactor provides the current capacity that the inverter requires during firing.

  The mains isolation contactor coil is driven through one of the normally-open contacts on the charging contactor. This prevents damage to the inverter in case of an I/O module failure.

Modified: 12/16/08

- **Medar MF1200:** The charging pack for the MF1200 inverter is a three-phase, full-wave bridge rectifier. The inverter controls the bridge rectifier by firing SCRs via a 15-position cable connected between the inverter and the bridge rectifier module. The DC bus is connected to the inverter using color-coded cables (red heat shrink for the positive bus and blue heat shrink for the negative bus).

Control Transformer

The control transformer receives the supply voltage (480, 415 or 380 VAC at 50 Hz or 60 Hz) from the circuit breaker. It reduces the supply voltage to the level required for other devices. It has step-down taps for

- 120 VAC outputs and

- Low-voltage (24 VAC) power to the electronics power input of the inverter regulator board.

MFDC Inverter

The MFDC inverter assembly consists of a regulator board, the charging pack, discharge resistors, capacitors and insulated gate bipolar transistors (IGBTs). The IGBTs control the time that current is allowed to pass to the welding transformer.

The regulator board receives the firing signal from the weld processor and translates the signal into target flux or current (depending on firing mode). The regulator fires the IGBTs and monitors to obtain the target.

The charging pack is described on page 1-24. The discharge resistors discharge the capacitors.

The capacitors smooth the VDC bus and provide energy during the weld.

The IGBTs are electronic switches that control when power is supplied to the welding transformer.

Inverters have at least one thermal switch that monitors temperature. The inverter will stop firing if a thermal switch trips.

The inverter is connected to the weld timer via the MedLAN cable (for fault information). Firing signals are provided to the inverter from the weld processor via the 15-pin connector on the regulator board.

The inverter provides the outputs to the welding transformer at H1 and H2.

Refer to the *MFDC Inverter Technical Reference* for specific information for each inverter.

Weld Processor

The weld processor provides direct communications.

When it receives a START WELD command from the host, the weld processor starts executing the weld sequence selected. When weld current will be required, it tells the inverter to fire. (The charging pack is already activated before the START WELD command.)

When the DC bus voltage stabilizes, the inverter is ready to weld. It activates the IRTW signal, and the weld processor is capable of sending firing signals to the inverter. The inverter performs the power conversion to provide the high-voltage DC current to the welding transformer.

At the end of the weld sequence, the weld processor drops out the isolation contactor for the weld transformer.

NOTE: *If your configuration provides the weld transformer isolation contactor, the inverter remains activated and is de-activated only by inverter fault conditions or power-down of the weld control. Refer to the drawings provided with your system for more information.*

The weld processor requests an upload of weld data and active fault conditions from the inverter. It functions as a slave device in the communications link. (It can only respond to requests for data; it cannot initiate communications with the weld processor.)

The weld processor indicates any fault conditions detected at the inverter, either at the data entry panel, or at another MedLAN device connected to the weld processor. (This can be the **Weld Support System** or **MedVIEW**.)

Faults generated in this system are of two types:

- Faults generated by the weld processor, and

- Faults generated by the MFDC inverter.

Inverter faults will de-energize the charging pack. Processor faults will inhibit the firing signal to the inverter (but do not de-energize the charging pack).

Installing the MedWeld 4000   2

To install the MedWeld 4000, you must provide the required connection (for either remote or discrete integration), configure the unit for the MedLAN network and program the weld processor to meet your application requirements.

These steps are described in the sections that follow.

Getting Started

· · · · · · · · · · · · · ·

Making the Required Connections

To aid in installing the MedWeld 4000, tear out or copy the "Installation Checklist" on page 2-26. Use it as a checklist to follow these steps:

1. Make certain the circuit breaker handle on the enclosure is in the OFF (DOWN) position before attempting to open the door.

WARNING!

The door is interlocked with the circuit breaker to prevent opening the cabinet door while power is applied. DO NOT attempt to force open the door. Damage to the cabinet may result.

2. Inspect the inside of the enclosure for any damage caused in shipping. Check for any parts which may have come loose in shipping, any packing materials or loose connections.

3. Check the drain holes on the bottom of the cabinet. Remove any tape affixed over these holes for shipping.

4. Place the enclosure in the desired location. Secure it with the mounting tabs and holes provided. The cabinet is designed to be mounted using all four mounting tabs.

	Caution: *When lifting any weight above 20 kg (~ 45 lb.),* *use either a two-man lift or an assisted lift.*

WARNING!	**WTC does NOT recommend drilling additional holes in the cabinet for additional brackets. If additional holes are required, make certain all components are covered to protect them from metal shavings. Metal debris (from drilling into the cabinet) can cause catastrophic failure. The WTC warranty does NOT cover damage caused by metal debris.**

5. Removable plates may be provided to connect cooling water, weld bus voltage, the welding transformer and to allow for wiring into the I/O.

6. The fittings for cooling water are located on the bottom (or side) of the cabinet. Either pipes or hoses are acceptable.

7. Connect the cooling water and test for leaks BEFORE any wiring into the control is performed, to reduce the risk of electrical shock.

	Caution: *Refer to page -xii for the requirements of cooling* *water quality and flow.*

8. With the welding bus power off and properly locked out, connect the power cables from the welding bus to the top of the circuit breaker.

9. Verify proper sizing of cabling from the bus to the circuit breaker, and from the control to the weld transformer's primary circuit. **Size 2/0 welding cable is recommended.** Refer to page 2-24.

10. Provide the connection to the weld transformer. (Refer to the electrical schematics supplied with the control for assistance in connecting the welding transformer.)

11. Provide the I/O connections based on the control's communication scheme. See "Providing I/O Connections" on page 2-4.

WARNING!

Check the control transformer for proper connections and voltage. Incorrect voltage from the control transformer can damage the I/O devices and/or present an electrical shock hazard to personnel.

12. Provide the MedLAN connections if a network connection is desired. Refer to "Providing MedLAN Connections" on page 2-5. Follow the recommendation provided in "MedLAN Wiring Specifications" on page 2-6.

Caution:
Physically separate the MedLAN cable from wiring greater than 50 volts. If the MedLAN cable must cross this wiring, it must do so at a 90° angle.

13. Inspect the setting of the circuit breaker's magnetic trip. Verify that this setting is correct. Refer to "Circuit Breaker" on page 1-4.

14. If using the optional communications daughter board, configure the FieldBus DIP switch. Refer to "Configuring the FieldBus Daughter Board" on page 1-10 for further details.

15. If using the optional secondary current coil, inspect it and verify that its orientation is correct and the 2-pin Phoenix connector is secure.

16. Inspect all connections and verify proper crimping and torque settings. Verify that there are NO line-to-line shorts.

17. When making all the electrical connections to/from the control, verify that each connection is secure. Refer to the tables listed in "Required Torque for Electrical Connections" on page 2-24.

18. Verify that all I/O are present and correctly assigned in the software. Refer to the schematics supplied with the control.

19. Turn on the cooling water and ensure proper flow rate. The MedWeld 4000 control is now ready to power up.

Caution:
The inverter continually generates heat during operation. Water cooling is required when the unit is turned on. See page page -xii for more details.

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20. Program the required weld schedules (see "Weld Schedules" on page 4-1). Program the required settings of setup parameters ("Setup Parameters" on page 5-1). Program the stepper profile (refer to "Stepper Data" on page 6-1).

21. Verify proper hand-shaking of the I/O on power-up.

The MedWeld 4000 is now ready for welding.

Providing I/O Connections

Some inputs/outputs require connection and configuration.

Providing Local I/O

As shipped from the factory, the MedWeld 4000 has two jumpers installed between J10 pins 10 - 11 and J10 pins 12 - 13 on the timer assembly. You can set up the CONTROL STOP input to use either an internal or external power source, as follows:

• To use the CONTROL STOP input with internal power, remove J10 pins 12 - 13. Place a normally-closed contact between these positions.

• To use the CONTROL STOP input with external power, remove BOTH J10 jumpers pins 10 - 11 and 12 - 13. Place a common on pin 11and a positive after the normally-closed contact on pin 12. Refer to the schematics supplied with the control.

FieldBus Communications

This communication scheme supports a network of DeviceNet or Profibus devices, allowing rapid communications between industrial devices.

To install the system using DeviceNet or Profibus communication, you must properly configure the FieldBus daughter board. For instructions on installation, refer to "Configuring the FieldBus Daughter Board" on page 1-10.

Finally, make the connection to the drop line at the terminal block plug provided on the DeviceNet or Profibus module.

Providing MedLAN Connections

MedLAN (WTC's Local Area Network) is a proprietary communications protocol. It defines how devices on the network communicate with each other.

NOTE: *The MedLAN address identifies each weld control's location on the network. Therefore, each weld control's address must be programmed* BEFORE *communication over the MedLAN channel is possible.*

Networking takes place over the MedLAN channel. Use a data entry device (DEP-100S, *WebVIEW, BANK* or *WSS*) for network communications, or to program a single weld control.

However, for the MedLAN network, you MUST use a DEP-100S Programming Device to program the MedLAN address for each control on the network through the programming port at the top of the card. Refer to Figure 7 on page 2-8.

NOTE: *In some configurations, a connector is provided on the door of the enclosure for convenience in connecting the DEP-100S. This port is internally wired to the weld processor card.*

This must be done before you can use MedLAN. If you do not program a MedLAN address, communication errors may result.

MedLAN and DEP-100S Connections

The network connection requires a Network Power Pack for power to the DEP-100S programming device.

A Brad-Harrison, 3-pin bulkhead connector is located at the top right corner of the network power pack. This connector provides external 110/220 VAC power. The DEP-100S then plugs into the connector on the face of the Network Power Pack.

The MedLAN cable connection originates at the 6-pin connector on the bottom of the Network Power Pack. This cable runs to the 3-pin MedLAN connector (J2) on the timer assembly board in the control.

For network configurations, the MedLAN cable connection is daisy-chained to the other controls on the network.

MedLAN Wiring Specifications

The MedLAN interface is an optically-isolated RS–485 connection. The interface is a 3-position, removable Phoenix connector with a pin spacing of 5 mm. The baud rate of this connection is 9,600.

Cable Requirements

WTC recommends using the Belden 9463 cable or equivalent. The following tables list the cable pinouts.

MedLAN Connector (on the Network Power Pack):

Designator	Pin #	Function	Wire Color (BELDEN #9463)
MDP2	6	+ 24 V.	
MDPS	5	Com	
MDP1	4	Not used	
MDL2 *	3	MedLAN Line 2	Clear
MDLS *	2	Line Shield	
MDL1 *	1	MedLAN Line 1	Blue

* Some versions of the control use a 6-pin MedLAN connector with all the positions connected as listed here. Other versions use a 3-pin MedLAN connector. It uses only these three pins as noted with an asterisk (*).

MedLAN Connector (on the weld processor card):

Designator	Pin #	Function	Wire Color (BELDEN #9463)
MDL2	3	MedLan Line 2	Clear
MDLS	2	Line Shield	
MDL1	1	MedLAN Line 1	Blue

WARNING!

⚠

NEVER connect any of the communication ports to the MDP- power wires. Damage to the ports or other internal components may result.

Designator	Function
MDL1 - MedLAN Line 1	This is the TX/RX + line of the RS–485 signal. Attach it to the blue wire of the cable.
MDL2 - MedLAN Line 2	This is the TX/RX – line of the RS–485 signal. Attach it to the clear or white wire of the cable.
Shield	Connect the shield to the drain wire of the cable.

Cable Routing Requirements

Wire the MedLAN network ONLY in a "daisy-chain" method. NEVER use "stub" wiring.

The maximum total length of the MedLAN network cable is 3,000 feet. Up to 30 weld controls may be connected to a single MedLAN network.

The MedLAN cable wire ends terminate into MTSB (Phoenix) connectors. Terminate the cable with this procedure:

1. Strip the cable jacket to 1 inch.

2. Remove foil shield strands outside the foil.

3. Cover the shield with heat shrink.

4. Cover the cable insulation end with one inch of heat-shrink tubing.

5. Strip 1/4 inch of insulation off each wire.

6. Install wires in each connector as shown in Figure 6 on page 2-8

7. Torque the terminal screws to 5 in.-lb.

Refer to Figure 6 below while terminating the cable.

Figure 6: *Terminating the MedLAN Cable*
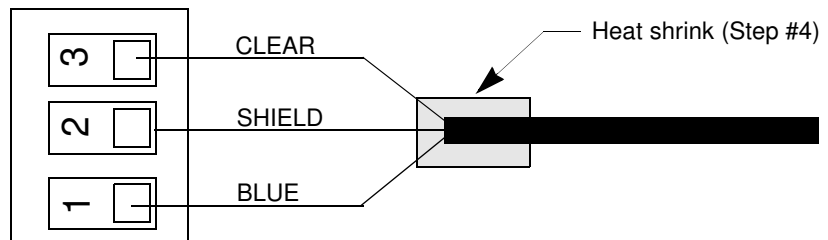
You must provide strain relief at the MedLAN cable entry and exit points at the weld control enclosure. If the enclosure requires drilling entry/exit holes, exercise caution to assure that no metal shavings are left inside the control.

WARNING!

Be certain to cover all components to protect them from metal shavings. Metal debris (from drilling into the cabinet) can cause catastrophic failure. The WTC warranty does NOT cover damage caused by metal debris.

Physically separate the MedLAN cable from wiring greater than 50 volts. If the MedLAN cable must cross this wiring, it must do so at a 90° angle.

Figure 7 below illustrates the recommended wiring configuration.

Figure 7: *Recommended MedLAN Wiring*
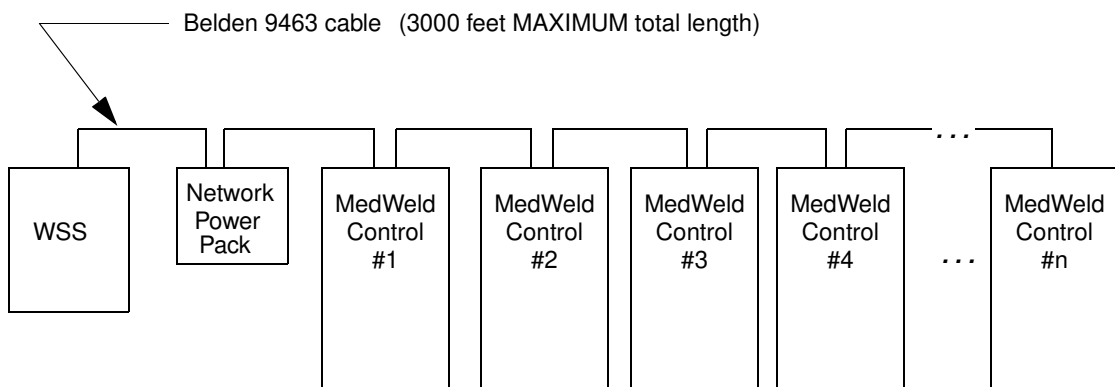
Setting the Weld Processor MedLAN Address

The MedWeld 4000 uses MedLAN (WTC's proprietary Local Area Network) to create a communications network between devices. After configuring each control, establishing the MedLAN connection and powering it up, you must set the MedLAN address for each device before it can respond to the network.

Use the DEP-100S to program the MedLAN address for each individual weld control, through the top (DEP) port of the weld processor card.

NOTE: *The steps required to set the address are listed on the next page. Refer to the manual provided with the DEP-100S programming device for more information on operation.*

Figure 8 below illustrates the layout of the DEP-100S keypad and LCD.

Figure 8: WTC DEP-100S Programming Device)

To set the address for each weld control, follow this procedure:

1. Plug the DEP-100S into the DEP (top) port on the weld processor card (or the DEP port on the enclosure door, if provided).

2. Press the **Program Mode** key. You will see this screen:

```
 _____
/                                                \
|  POWER ON                         COMM ON       |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|            - PROGRAM MODE -                     |
|                                                 |
|  REVIEW       REVIEW       REVIEW     RELOAD     |
|  SCHEDULE     STEPPER      SETUP      DEFLT   *  |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|    F1           F2           F3         F4       |
\                                                 /
 _____/
```

3. Press ⌷F5⌷ on the DEP-100S (for additional functions). The following screen appears.

```
 _____
/                                                \
|  POWER ON                         COMM ON       |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|            - PROGRAM MODE -                     |
|                                                 |
|  WELDER      TRANSFER     NETWORK    ANALOG      |
|  ID          DATA         ADDR       DATA    *  |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|    F1           F2           F3         F4       |
\                                                 /
 _____/
```

4. Press ⌷F4⌷ to select network addressing (**NETWORK ADDR**). This display will appear.

```
 _____
/                                                \
|POWER ON                           COMM ON       |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|        NETWORK ADDRESS PROGRAMMING              |
|                                                 |
|                                                 |
|  port #02                  download    exit     |
| . . . . . . . . . . . . . . . . . . . . . . . . |
|      F1           F2           F3         F4     |
\                                                 /
 _____/
```

5. Press the ⌷F1⌷ key to select the port # (MedLAN address).

6. With the numeric keys, enter an address ("port") number (00–29). In the example shown, the address is port 02. Entering **99** for an address disables communications.

7. Press ⌷Enter⌷ to tell the DEP-100S you have completed your selection.

8. Press ⌷ F3 ⌷ (**download**) to send the new MedLAN address to the device. A message that the download was completed will appear briefly.

9. Unplug the DEP-100S and move to the next control. Follow this procedure for every control in the network.

Caution:

*Make certain that each device has a **unique** address. Duplicate addresses may cause the network to lock up.*

Programming the Weld Processor

Each weld processor provides multiple functions for defining weld schedules. It also lets you configure the device to meet your application requirements by programming setup parameters. The control also provides a programmable stepper to compensate for lost current density over the life of the electrodes.

All of these features are programmable from several different programming devices:

- Plug the DEP-100S programming device into the connector on the enclosure door or on the weld processor module or the WTC Network Power Pack.

- When connecting the MedWeld 4000 to a network controlled by the WTC Weld Support System (XWSS), programming and data acquisition can be done through WTC's proprietary programs.

- Use the WebVIEW communication program to program weld schedules, steppers and setup parameters from a Web server interface.

Each programming option is outlined below. For more complete information, refer to the manual provided with each programming device.

DEP-100S Programming Device

WTC's DEP-100S Programming Device is a data entry device. Use it to program one, several or up to 30 weld processors on a MedLAN network.

• When programming locally, the DEP-100S is plugged directly into the port on the WTC control.

• When using a MedLAN network, a WTC Network Power Pack is required to provide external power for the DEP-100S.

When communicating through a local port, the DEP-100S is still required (to set the MedLAN address for each weld processor). The DEP-100S is shown in Figure 8 on page 2-9. Its multi-line display and "soft" function keys allow you to see weld data or to program weld settings.

As described in the *DEP-100S Programming Guide*, the DEP-100S displays information based on the software revision contained in both the DEP and the weld processor.

This manual explains how to use displays that are specific to the MedWeld 4000 processor. Refer to "Display at the DEP-100S" on page 6-3 for details on how to use the DEP-100S **Stepper Status** and **Stepper Profile** programming displays.

You can program any provided input/output to correspond to any I/O position on the Discrete I/O board. For more details, see "Programmable Inputs/Outputs" on page 3-4.

How to Program I/O Mappings

The MedWeld 4000 has a new capability to assign any Discrete or FieldBus I/O point to any I/O function. This section explains how to program I/O mappings for all types of MedWeld 4000 control.

Mappings of I/O numbers to I/O names are not fixed. Instead, you can set any input or output to correspond to any I/O position on the Discrete I/O board or FieldBus I/O transfer.

This assignment is accomplished through either the **I/O Mapping** or **FieldBus Mapping** screens in the **Program** display mode of the DEP-100S.

Initial Preparation for I/O Assignment

BEFORE entering any programming changes to I/O, follow this procedure:

1. Turn OFF power to the control.

2. Locate the RUN/PROGRAM jumper on the timer board.

3. Set the RUN/PROGRAM jumper to PROGRAM mode.

4. Turn ON power to the control.

5. Connect the DEP-100S at port **J8** on the timer assembly. Use the Door Port Interface Kit (WTC p/n 830-0654).

6. After the DEP-100S powers up, press the PROGRAM MODE key. This screen appears first:

```
 HHT #200                                    COMM ON
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                        - PROGRAM MODE -


   REVIEW          REVIEW         REVIEW      RELOAD
   SCHEDULE        STEPPER        SETUP       DEFLT     *
 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      F1              F2             F3          F4
```

7. Perform the appropriate step as follows:

    •   In program T03300 (AC controls), proceed to "T03300 (AC Controls)" on page 2-14; or

    •   In program T02300 (Type 1 inverter controls), proceed to "T02300 (Type 1 Inverter Controls)" on page 2-15.

TO3300 (AC Controls)

8. Press F5 to pan to these additional options:

```
 ⎛ HHT #200                            COMM ON ⎞
 ⎜ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ⎟
 ⎜              - PROGRAM MODE -                ⎟
 ⎜                                              ⎟
 ⎜                                              ⎟
 ⎜  WELDER      TRANSFER      NETWORK      IO    ⎟
 ⎜    ID          DATA          ADDR    MAPPING* ⎟
 ⎜ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ⎟
 ⎝    F1          F2            F3        F4     ⎠
```

9. Either

    •   Press F4 from this screen to present the **IO Mapping** option. Proceed to "Options for Mapping I/O" on page 2-16); or:

    •   Press F5 again to show the **Fieldbus Mapping** option on the next screen:

```
 ⎛ HHT #200                            COMM ON ⎞
 ⎜ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ⎟
 ⎜              - PROGRAM MODE -                ⎟
 ⎜                                              ⎟
 ⎜                                              ⎟
 ⎜  FIELDBUS                                    ⎟
 ⎜   MAPPING                                    ⎟
 ⎜ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - ⎟
 ⎝    F1          F2            F3        F4     ⎠
```

10. From this screen, select F1 to access the option for mapping FieldBus I/O. Proceed to "Options for Mapping I/O" on page 2-16).

T02300 (Type 1 Inverter Controls)

1. Press ⎡F5⎤ to pan to these additional options:

```
 ╭─────────────────────────────────────────╮
 │  HHT #200                       COMM ON  │
 │  - - - - - - - - - - - - - - - - - - - - │
 │              - PROGRAM MODE -            │
 │                                          │
 │                                          │
 │   WELDER    TRANSFER    NETWORK   ANALOG │
 │     ID        DATA        ADDR     DATA  *│
 │  - - - - - - - - - - - - - - - - - - - - │
 │     F1         F2          F3       F4   │
 ╰─────────────────────────────────────────╯
```

2. Press ⎡F5⎤ again to show the **IO Mapping** and **Fieldbus Mapping** options:

```
 ╭─────────────────────────────────────────╮
 │  HHT #200                       COMM ON  │
 │  - - - - - - - - - - - - - - - - - - - - │
 │              - PROGRAM MODE -            │
 │                                          │
 │                                          │
 │     IO      FIELDBUS                     │
 │  MAPPING    MAPPING                      │
 │  - - - - - - - - - - - - - - - - - - - - │
 │     F1         F2          F3       F4   │
 ╰─────────────────────────────────────────╯
```

3. From this screen, select either:

4. ⎡F1⎤ to access the options for mapping Discrete I/O. Proceed to "Options for Mapping I/O" on page 2-16), or

5. ⎡F2⎤ to access the options for mapping FieldBus I/O. Proceed to "Options for Mapping I/O" on page 2-16).

Options for Mapping I/O

To set the options for mapping Discrete or FieldBus I/O, follow these steps:

1. Press ⌈F4⌉ to select the **IO Mapping** option. Either this screen will appear:

```
 HHT #200                               COMM ON
 ----------------------------------------------
 (1)  Discrete IO Options
 (2)  Map Discrete Inputs
 (3)  Map Discrete Outputs


 ----------------------------------------------
    F1            F2            F3          F4
```

In this screen, select one of the three menu options presented:

*   **(1) Discrete IO Options**: Proceed to "The I/O Options Screen (Discrete)" on page 2-17.

    OR this screen appears after selecting the the **Fieldbus Mapping** option from the **IO Mapping** screen shown on page 2-15:

```
 HHT #200                               COMM ON
 ----------------------------------------------
 (1)  Fieldbus IO Options
 (2)  Map Fieldbus Inputs
 (3)  Map Fieldbus Outputs


 ----------------------------------------------
    F1            F2            F3          F4
```

*   **(1) Fieldbus IO Options**: Proceed to "The I/O Options Screen (FieldBus)" on page 2-18.

The I/O Options Screen (Discrete)

To set the Discrete I/O options, press the **1** key while in the **IO Mapping** screen shown above. This screen now appears:

```
 HHT #200                           COMM ON
 ------------------------------------------
 S T A R T   O F   I O   O P T I O N S
 ▮RELOAD DIO DEFAULTS: DEFAULT 1
 ISOLATION CONTACTOR: DISABLED
 E N D   O F   I O   O P T I O N S
 wcu #00                download      exit
 ------------------------------------------
     F1            F2            F3         F4
```

Follow these steps:

1. Use the ⬆ or ⬇ keys as needed to scroll to the **RELOAD DIO DEFAULTS:** option.

NOTE: *If resetting the defaults, cycle power to the control* OFF, *then back* ON, *before programming any additional changes.*

2. Press ➡ to reload from one of the supplied Discrete I/O defaults. Selecting **OFF** performs no action. Selecting **Default 1** reloads from the supplied Default 1. Selecting **Default 2** reloads from the supplied Default 2.

3. Press ⬇ to scroll down to the **ISOLATION CONTACTOR:** option.

4. If your control has the optional isolation contactor, use ⬅ or ➡ as needed to set this option **ENABLED** for programming.

5. If no isolation contactor is included, set the option **DISABLED**.

6. To accept these settings for downloading, press F3. A message, **DOWNLOAD COMPLETE -- RESTART TIMER**, appears momentarily.

NOTE: *If the* Normal/Program *jumper is not in the proper position, the DEP will indicate ... and reset the options to what is currently programmed in the control.*

7. To exit this screen and return to the **IO Mapping** screen, press F4.

NOTE: *For the changes you entered to take effect, you must reset the weld processor to* RUN *mode. You may make all programming changes before cycling power to the control.*

8. Turn OFF power to the control.

9. On the timer board, set the RUN/PROGRAM jumper to RUN mode.

10. Turn ON power to the control. The settings you downloaded will now take effect.

The I/O Options Screen (FieldBus)

To set the FieldBus I/O options, press the **1** key while in the **IO Mapping** screen on page 2-16. This screen now appears:

```
 HHT #200                            COMM ON
-------------------------------------------
S T A R T   O F   I O   O P T I O N S
█RELOAD FIELDBUS DEFAULTS: OFF
FIELDBUS SIZE (WORDS): 1
E N D   O F   I O   O P T I O N S
wcu #00              download      exit
-------------------------------------------
   F1          F2          F3          F4
```

Follow these steps:

1. Use the ⬆ or ⬇ keys as needed to scroll to the **RELOAD FIELDBUS DEFAULTS:** option.

NOTE: *If resetting the defaults, cycle power to the control* OFF, *then back* ON, *before programming any additional changes.*

2. Press ➡ to reload from one of the supplied FieldBus I/O defaults. Selecting **OFF** performs no action. Selecting **Default 1** reloads from the supplied Default 1. Selecting **Default 2** reloads from the supplied Default 2.

3. Press ⬇ to scroll down to the **FIELDBUS SIZE (WORDS):** option.

4. Press ➡ to select the FieldBus word size. **0** disables FieldBus communication. **1** sets the word size to 16 inputs or outputs. **2** sets the word size to 32 inputs or outputs.

5. To accept these settings for downloading, press F3 . A message, **DOWNLOAD COMPLETE -- RESTART TIMER**, appears momentarily.

•   **(2) Map Discrete [FieldBus] Inputs**: Proceed to "Mapping Inputs" on page 2-19.

Mapping Inputs

To change the mapping of input points to input names, press the **2** key while in the **IO Mapping** screen. This screen appears:

```
 ┌─────────────────────────────────────────────┐
 │  HHT #200                          COMM ON   │
 │  ------------------------------------------- │
 │  S T A R T   O F   I O   M A P               │
 │ ▐INPUT 01: BINARY SELECT 1 / PILOT 1         │
 │  INPUT 02: BINARY SELECT 2 / PILOT 2         │
 │                                              │
 │  wcu #00              download      exit     │
 │  ------------------------------------------- │
 │     F1          F2          F3          F4   │
 └─────────────────────────────────────────────┘
```

This example is for reference only. What you see will vary, depending on your application and the input mapping currently entered.

Follow these steps:

1. Using the ⬆ or ⬇ keys as needed, scroll to the desired input position number. For example, Input 09 might now have the PRESSURE SWITCH input, but you want to assign the STEPPER RESET GROUP 1 input to this input position number. The screen would look like this:

```
 ┌─────────────────────────────────────────────┐
 │  HHT #200                          COMM ON   │
 │  ------------------------------------------- │
 │  INPUT 08: FAULT RESET                       │
 │ ▐INPUT 09: PRESSURE SWITCH                   │
 │  INPUT 10: NONE                              │
 │                                              │
 │  wcu #00              download      exit     │
 │  ------------------------------------------- │
 │     F1          F2          F3          F4   │
 └─────────────────────────────────────────────┘
```

2. With the cursor at Input 09, press ⬅ or ➡ as needed to scroll through the list of available input names. This screen appears:

```
 ┌─────────────────────────────────────────────┐
 │  HHT #200                          COMM ON   │
 │  ------------------------------------------- │
 │                                              │
 │  INPUT 09: PRESSURE SWITCH                   │
 │                                              │
 │                                              │
 │  wcu #00              download      exit     │
 │  ------------------------------------------- │
 │     F1          F2          F3          F4   │
 └─────────────────────────────────────────────┘
```

3. In the next example, Input 09 is now assigned to the STEPPER RESET GROUP 1 input. Use the ← and → keys, repeating as needed to display this desired input:

```
╭─────────────────────────────────────────────╮
│  HHT #200                          COMM ON    │
│  - - - - - - - - - - - - - - - - - - - - -    │
│                                               │
│  INPUT 09: STEPPER RESET GROUP 1              │
│                                               │
│                                               │
│  wcu #00                 download      exit   │
│  - - - - - - - - - - - - - - - - - - - - -    │
│     F1          F2          F3          F4    │
╰─────────────────────────────────────────────╯
```

4. To assign the input position number to the desired input (Input 09 to the STEPPER RESET GROUP 1 input in this example), press F3. A message, **DOWNLOAD COMPLETE -- RESTART TIMER**, appears momentarily.

5. To exit this screen and return to the **IO Mapping** screen, press F4.

NOTE: *For the changes you entered to take effect, you must reset the weld processor to* RUN *mode. You may make all programming changes before cycling power to the control.*

6. Turn OFF power to the control.

7. On the timer board, set the RUN/PROGRAM jumper to RUN mode.

8. Turn ON power to the control. The settings you downloaded will now take effect.

• **(3) Map Discrete [FieldBus] Outputs**: Proceed to "Mapping Outputs" on page 2-21.

Mapping Outputs

To change the mapping of output points to output names, press the **3** key while in the **IO Mapping** screen. This screen appears first:

```
┌─────────────────────────────────────────────┐
│  HHT #200                          COMM ON    │
│ --------------------------------------------- │
│  S T A R T   O F   I O   M A P                │
│ █OUTPUT 01: VALVE1 / BINARY VALVE 1           │
│  OUTPUT 02: VALVE2 / BINARY VALVE 2           │
│                                               │
│  wcu #00                  download      exit  │
│ --------------------------------------------- │
│     F1           F2            F3        F4    │
└─────────────────────────────────────────────┘
```

This example is for reference only. What you see will vary, depending on your application and the output mapping currently entered. Follow these steps:

1. Using the ⬆ or ⬇ keys as needed, scroll to the desired output position number. For example, Output 06 might now have the PRESSURE SELECT 2 output, but you want to assign the INTENSIFICATION VALVE output. The screen would look like this:

```
┌─────────────────────────────────────────────┐
│  HHT #200                          COMM ON    │
│ --------------------------------------------- │
│  OUTPUT 04: VALVE4 / BINARY VALVE 8           │
│  OUTPUT 05: PRESSURE SELECT 3                 │
│ █OUTPUT 06: PRESSURE SELECT 2                 │
│                                               │
│  wcu #00                  download      exit  │
│ --------------------------------------------- │
│     F1           F2            F3        F4    │
└─────────────────────────────────────────────┘
```

2. With the cursor at Output 06, press ⬅ or ➡ as needed to scroll through the list of available outputs. This screen appears:

```
┌─────────────────────────────────────────────┐
│  HHT #200                          COMM ON    │
│ --------------------------------------------- │
│                                               │
│  OUTPUT 06: PRESSURE SELECT 2                 │
│                                               │
│                                               │
│  wcu #00                  download      exit  │
│ --------------------------------------------- │
│     F1           F2            F3        F4    │
└─────────────────────────────────────────────┘
```

3. In the next example, Output 06 is now assigned to the INTENSIFICATION VALVE output. Use the ← and → keys, repeating as needed to display this screen:

```
┌─────────────────────────────────────────────┐
│                                             │
│  HHT #200                          COMM ON  │
│  - - - - - - - - - - - - - - - - - - - - -  │
│                                             │
│                                             │
│  OUTPUT 06: INTENSIFICATION VALVE           │
│                                             │
│                                             │
│  wcu #00                 download     exit  │
│  - - - - - - - - - - - - - - - - - - - - -  │
│     F1          F2          F3        F4    │
└─────────────────────────────────────────────┘
```

4. To assign the output position number to the desired output (Output 06 to the INTENSIFICATION VALVE output in this example), press the F3 key. A message, **DOWNLOAD COMPLETE -- RESTART TIMER**, appears momentarily.

5. To exit this screen and return to the **IO Mapping** screen, press F4.

NOTE: *For the changes you entered to take effect, you must reset the weld processor to* RUN *mode. You may make all programming changes before cycling power to the control.*

6. Turn OFF power to the control.

7. On the timer board, set the RUN/PROGRAM jumper to RUN mode.

8. Turn ON power to the control. The settings you downloaded will now take effect.

Required Electrical Connections
•   •   •   •   •   •   •   •   •   •   •   •   •   •

All electrical connections must be mechanically clean and secure. They should have no signs of wear, fretting, damage or chemical corrosion.

These requirements are CRITICAL for the high-voltage power connections to, from and within the control. The customer must complete these connections:

Power Connections

•   The incoming power feed lines L1, L2 and L3 enter the circuit breaker 1CB. For more details, refer to "Required Torque for Electrical Connections" on page 2-24.

•   The connection between connector 1CI on the 689 board and the 1PD board (for a Type 1 inverter, p/n 955-5000), or the 1CPU board (for a Type 2 inverter, p/n 955-6000). This applies only to integration kits.

I/O Connections

•   If operating the control on a network, connect the MedLAN connector J2 on the weld processor board 1CPU.

•   For support of analog I/O, either or both connectors J4 and/or J5 on the weld processor board 1CPU (Type 2 inverter). Wire a ferrite bead across each connection.

•   If using the transformer over-temperature switch, wire to terminals 1TB/TS1 and 1TB/TS2 on terminal block 1TB.

•   The CONTROL STOP signal can be internally- or externally-sourced. Refer to the schematics supplied with the control for the available wiring options.

•   If using the Type 1 inverter, the secondary current-sensing coil 1CC has leads designated 1RD-J2-1 and 1RD-J2-2. Connect these leads to terminals 1 and 2 on connector J2 of the 7923 board, 1RD.

•   Connect the I/O according the communication scheme being used:

    •   **DIO:** Discrete wiring to each required connector.

    •   **DNET:** Connect the DeviceNet cable to connector J3 on the communications daughter board.

    •   **Profibus:** Connect the DB-9 cable to connector J2 on the communications daughter board.

    •   **Serial I/O:** Connect Belden #9463 ("Blue Hose") cable to connector J4 on the communications daughter board.

Required Torque for Electrical Connections

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All electrical connections must be mechanically clean and secure, without signs of wear, fretting, damage or chemical corrosion. These requirements are CRITICAL for the high-voltage power connections to, from and within the control.

This section lists the recommended torque specifications and cable sizes for SCRs, circuit breakers and contactors. Refer to the NEC tables for guidance in sizing cables. Refer to the following tables when making electrical connections. Be sure to observe these specifications exactly.

Required Torque: SCRs

Device	Suggested Cable Size	Captive Nut Assy. (Copper Lug or Bus Direct to Device)	Cable Lug	Flexibar to Lug or Device Tang

600 A. SCR
    Darrah Q20008
    Dynex MP02TT800
		3.6 lb.-ft. (5 n-m)	N/A	N/A

1,200 A. SCR
    Darrah Q20001P
    Powerex ND431825
		8 lb.-ft. (11 n-m)	N/A	N/A

1,650 A. SCR
    Eupec T425N18KOF
    Powerex LD431850
		9 lb.-ft. (12 n-m)	N/A	N/A

1,800 A. SCR
    Darrah Q20011
    Dynex MP04TT1400
		9 lb.-ft. (12 n-m)	N/A	N/A

1,750 A. SCR
    Darrah DPH7844-468C
    Darrah DPH7845-2.5
		N/A	25 lb.-ft. (34 n-m)
			3/8 in. bolt
				16 lb.-ft. (22 n-m)
				3/8 in. bolt

2,500 A. SCR
    Darrah DPH7824-468F
    Darrah DPH7406-469C
		N/A	25 lb.-ft. (34 n-m)
			3/8 in. bolt
				16 lb.-ft. (22 n-m)
				3/8 in. bolt

Required Torque: Circuit Breakers

Device	Suggested Cable Size	Captive Nut Assy. (Copper Lug or Bus Direct to Device)	Cable Lug	Copper Bus to Lug or Device Tang
ABB S3 breaker		6.64 lb.-ft. (9 n-m)	10 lb.-ft. (13.5 n-m) ABB K4TC	N/A
ABB S4 breaker		6.64 lb.-ft. (9 n-m)	10 lb.-ft. (13.5 n-m) ABB K4TC	N/A
			22.9 lb.-ft. (31 n-m) ABB K4TE	
ABB S5 breaker		13.25 lb.-ft. (18 n-m)	31 lb.-ft. (42 n-m) ABB K4TF	N/A
			22.9 lb.-ft. (31 n-m) ABB K4TG	
ABB S6 breaker		13.25 lb.-ft. (18 n-m)	31 lb.-ft. (42 n-m) ABB K4TJ	N/A
			22.9 lb.-ft. (31 n-m) ABB K4TH	
ABB S7 breaker		13.25 lb.-ft. (18 n-m)	31 lb.-ft. (42 n-m) ABB K7TK	N/A

Required Torque: Contactors

Device	Suggested Cable Size	Captive Nut Assy. (Copper Lug or Bus Direct to Device)	Cable Lug	Copper Bus to Lug or Device Tang
ABB A110 contactor		N/A	4.4 lb.-ft. (6 n-m) captive	N/A
ABB A145 contactor		6.64 lb.-ft. (9 n-m)	N/A	N/A
ABB A185 contactor		6.64 lb.-ft. (9 n-m)	N/A	N/A
ABB A300 contactor		13.25 lb.-ft. (18 n-m)	N/A	N/A
ABB EHW 145 contactor		N/A	N/A	25 lb.-ft. (34 n-m) 3/8 in. bolt
ABB EHW 160 contactor		N/A	N/A	25 lb.-ft. (34 n-m) 3/8 in. bolt
ABB EHW 250 contactor		N/A	N/A	25 lb.-ft. (34 n-m) f3/8 in. bolt

Installation Checklist

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Copy or tear out this checklist, to aid in installing the MedWeld 4000. Be certain to verify and check off each step after performing it. Also, the responsible service technician should sign their initials after completing each step.

Step Number	Check-off	Initials	Action to Take
Step 1	☐	_____	Ensure proper lock-out at welding bus. Circuit breaker handle DOWN.
Step 2	☐	_____	Inspect interior of control for loose/missing parts and/or damage in shipping.
Step 3	☐	_____	Check drain holes; ensure they are open.
Step 4	☐	_____	At desired location, mount control by **ALL 4** mounting tabs.
Step 5	☐	_____	Remove access plates to drill for: Weld bus, cooling water, welding transformer and I/O.
Step 6	☐	_____	Connect cooling water supply to fittings.
Step 7	☐	_____	Lock-out at welding bus. Connect power cables: Bus to line side (top) of circuit breaker.
Step 8	☐	_____	Connect weld transformer.
Step 9	☐	_____	Connect all I/O points.
Step 10	☐	_____	Connect external power. **WARNING! Verify Proper connections and voltage.**
Step 11	☐	_____	Make MedLAN connections.
Step 12	☐	_____	Verify CORRECT magnetic trip setting on circuit breaker.
Step 13	☐	_____	(If using optional FieldBus communications): Configure DIP switch on daughter board.
Step 14	☐	_____	(If using optional secondary current coil): Inspect and verify correct orientation and secure connection.

Step 15 ☐ _____ Inspect all connections: Verify proper crimping and torque. Verify NO line-to-line shorts. Refer to page 2-25.

Step 16 ☐ _____ Verify all I/O are present and correctly assigned in software.

Step 17 ☐ _____ Ensure cooling water supply and proper flow rate.

Step 18 ☐ _____ Program required weld schedules, settings for setup parameters and stepper profile.

Step 19 ☐ _____ Verify proper hand-shaking of I/O on power-up.

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Communications and I/O   3

The MedWeld 4000 communicates with automation equipment using one of these schemes:

- *DeviceNet*, where I/O is transmitted to a DeviceNet drop line and sent to a network via the host.

- *Profibus*. An open, digital communication system with many applications in factory and process automation.

- *Discrete I/O*. Inputs and outputs are directly wired into the control's enclosure.

This chapter defines the inputs to the MedWeld 4000, and the outputs that it provides.

The following sections describe each option and the I/O provided.

Local I/O

When the MedWeld 4000 is part of a network using any communication scheme, the timer directly provides for local control of certain critical inputs and outputs.

These I/O are the same for both communication scheme. As described in "Providing Local I/O" on page 2-5, the connections to these I/O should be provided. These tell the processor factors such as the status of the isolation contactor and CONTROL STOP condition.

This I/O is in addition to the I/O mapping provided for discrete I/O and FieldBus operation.

Local Inputs

The Control Stop input is 24 VDC. It can be either internally- or externally-powered. Refer to "Providing Local I/O" on page 2-5 for more information.

CONTROL STOP Input   CSTP

If this is dropped during a schedule, when this input is de-activated, the control aborts the present schedule and will not initiate another schedule until the input becomes activated. The isolation contactor also drops out (to disable weld current). A CONTROL STOP fault condition is generated. See page 5-2 for more details.

Attempting to initiate a weld when this input is inactive will generate a CONTROL STOP fault.

ISOLATION CONTACTOR Input   IC

This is an input to the weld control enclosure, showing whether the isolation contactor is open or closed. It is normally closed.

If this contact fails to change state when the control attempts to pass current, the control will generate an ISO-CNTR OFF WHEN NEEDED fault condition and trip the circuit breaker. Refer to page 5-5 for more information about this fault.

If this contact fails to return to its original state after the contactor is turned off (including the Isolation Contactor Delay), the control will generate an ISO-CNTR ERR BKR TRIPPED fault condition, and trip the circuit breaker.

THERMAL SWITCH Input   TS2

This input to the weld processor indicates that the SCR module has reached an over-temperature condition.

If this input is not active when the control receives the signal to initiate a weld, the weld processor completes the schedule in No Weld and generates a SYSTEM COOLING fault. See page 5-6 for more details.

INVERTER READY TO WELD   (IRTW)

(Progams T02300 and T02400 only): This is an input to the weld processor from the inverter. It indicates that the following conditions are true at the inverter, and the inverter is ready to receive a firing signal from the weld sequence:

• The inverter thermal switches indicate that cooling water is present.

• The isolation contactor is ready to be pulled in (to provide weld current).

• No fault conditions exist at the inverter.

- The charging pack is ready to be activated (to charge the inverter capacitors and provide DC bus voltage).

TRANSFORMER OVER-TEMPERATURE Input

(Type 1/Type 2 inverters in FieldBus communications only):
This input tells the state of the cooling system. It is provided as an external welding transformer over-temperature switch. If not used, this input must be jumpered HIGH.

If this input is not active when the control receives a schedule initiate, a SYSTEM COOLING fault will be generated and the NO FAULT output will be de-energized.

A SYSTEM COOLING fault also occurs if a weld schedule contains Function #79 (WAIT nnn CY FOR SYSTEM COOLING), and this input does not become active within the number of cycles specified.

Local Outputs

ISOLATION CONTACTOR Output ISOC

The ISOLATION CONTACTOR output operates the weld transformer isolation contactor. Refer to page 5-5 for further information.

SHUNT TRIP Output

Activating this output trips the circuit breaker in case of a catastrophic failure.

Programmable Inputs/Outputs

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The MedWeld 4000 provides for programmable input/output assignments, or mappings. An input mapping lists input numbers 01 - 16 and their respective input names. An output mapping lists output numbers 01 - 10 and their respective output names.

Below are examples of I/O mappings. To learn how to program them using the DEP-100S, see "How to Program I/O Mappings" on page 2-14.

Example Input Mapping

Any input mapping can have 16 or 32 inputs, to supply the input points of one (or two) Discrete I/O board(s). Word size in FieldBus is 0, 1 or 2 I/O bits. Word size in discrete is 0, 16 or 32 I/O bits. Here is an example:

```
01  BINARY SELECT 1 / Pilot 1
02  BINARY SELECT 2 / Pilot 2
03  BINARY SELECT 4 / Pilot 3
04  BINARY SELECT 8 / Pilot 4
05  WELD INITIATE
06  WELD / NO WELD
07  STEPPER RESET
08  FAULT RESET
09  PRESSURE SWITCH
10  NONE
11  RETRACT PILOT 1
12  RETRACT PILOT 2
13  TRANSFORMER OVERTEMP
14  PROGRAM SECURITY
15  HEAT DISPLAY SECURITY
16  NONE
```

Example Output Mapping

Any output mapping can have 10 or 20 outputs, to supply the output points of one (or two) Discrete I/O board(s). Word size in FieldBus is 0, 1 or 2 I/O bits. Word size in discrete is 0, 10 or 20 I/O bits. For example:

```
01  VALVE #1
02  VALVE #2
03  VALVE #3
04  VALVE #4
05  PRESSURE SELECT #1
06  PRESSURE SELECT #2
07  RETRACT #1
08  RETRACT #2
09  WELD / NO WELD
10  NO FAULT
```

Supported I/O

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In program T03300 (AC controls), the Fieldbus and Discrete inputs are the same. Fieldbus and Discrete have the same outputs in common. For the listing of supported I/O in this program, see page 3-20.

In program T02300 (Type 1 inverter controls), the Fieldbus and Discrete inputs are the same. Fieldbus and Discrete have the same outputs in common. For the listing of supported I/O in this program, see page 3-18.

For descriptions of the I/O, refer to "Input Definitions" on page 3-6 and "Output Definitions" on page 3-10.

NOTES: *The control does not operate when in Program mode. Changes to programmed I/O are possible only while in this mode.*

For the changes you program to I/O to take effect, you must cycle power to the control OFF, then back ON.

If changing the FieldBus word size, you must cycle power to the control OFF, then back ON.

The I/O tables configured on power-up are based on the most recently-programmed I/O mappings.

Input Definitions

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Schedule initiation is ***binary***. Binary initiation sets the desired schedule number as the total of all the weighted values of BINARY SELECT inputs for that schedule number. For example, BS1 + BS2 will initiate Sequence #03 (because 1 + 2 = 3). BS1 + BS3 + BS4 + BS6 initiates Sequence #45 (because 1 + 4 + 8 + 32 = 45), etc., AND the WELD INITIATE input is true for that binary combination.

Input Descriptions

This section describes the possible input signals that can be provided to the control. At the right of each input label, abbreviations are as they appear on the **I/O Status** screen of the DEP-100S data entry panel.

BINARY SELECT 1 Input	**BS1**
BINARY SELECT 2 Input	**BS2**
BINARY SELECT 4 Input	**BS4**
BINARY SELECT 8 Input	**BS8**
BINARY SELECT 16 Input	**BS16**
BINARY SELECT 32 Input	**BS32**
BINARY SELECT 64 Input	**BS64**

These inputs select the schedule to be initiated (1 – 99). The schedule is selected by a combination of these inputs. Each input has a weighted value (1, 2, 4, 8, 16, 32 or 64). The schedule initiated is the one selected by adding the weighted values of the active inputs.

For example, to initiate schedule #4, activate BINARY SELECT Input #4. To initiate schedule #7, activate BINARY SELECT Inputs #1, #2 and #4 (because 1 + 2 + 4 = 7).

WELD INITIATE Input   **INT**

When this input is activated, the weld control executes the schedule that was selected by the BINARY SELECT inputs.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

WELD / NO WELD Input   **WLD**

This is a Weld input to the control. With this input closed (HIGH = 1), the control is in Weld mode. If this input is open (LOW = 0), the control is in No Weld mode.

With this input open (No Weld mode), the control will turn on the NO WELD output (if programmed), no weld current will flow and the NO WELD fault is issued.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

ISOLATION CONTACTOR SAVER   CSVR

This input tells the weld processor to enable the isolation contactor delay timer. The delay timer (programmed in the setup parameters, as described on page 5-13) holds the isolation contactor closed after a weld schedule is completed, to prevent it from dropping out between welds.

If this input is active at the end of a schedule, the weld processor will hold the isolation contactor closed for the amount of time programmed. For further details, see page 5-13.

If this input is not active, the isolation contactor will drop out at the end of the weld schedule. However, if this input drops out during the delay time, the remaining time on the delay timer is aborted and the isolation contactor is immediately opened.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

FAULT RESET Input   FR

This input allows the user to remotely reset all faults.

TRANSFORMER OVERTEMP   TROT

This input tells the state of the transformer and external cooling system. It is provided as an external welding transformer over-temperature switch. If not using this input and it is programmed, jumper it HIGH.

If this input is not active when the control receives a schedule initiate, a SYSTEM COOLING fault will be generated, and the NO FAULT output will be de-energized.

A SYSTEM COOLING fault also occurs if a weld schedule contains Function #79 (WAIT nnn CY FOR SYSTEM COOLING), and this input does not become active within the number of cycles specified.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

NO STROKE/NO WELD Input   NSNW

When this input is active, the control is in No Stroke/No Weld. This tells the weld control to cycle without supplying current and without turning on the valves. This input affects the weld valves only. It does not affect any other outputs.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

PROGRAM SECURITY   PSEC

If this input is active (locked HIGH), only data under the Stepper Status Mode and Heat Display Mode can be changed.

If this input is used in conjunction with the HEAT MODE SECURITY input, only data under the Stepper Display Mode can be changed.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

HEAT MODE SECURITY   HSEC

This input must be used in conjunction with the PROGRAM MODE SECURITY input. If this input is active (locked HIGH), NO changes can be made to any of the programmable data except under the Stepper Status Mode.

Setting this input to **0** means the input defaults to <u>open</u>. Setting to **1** means the input defaults to <u>closed</u>.

PRESSURE SWITCH Input   PS1

If the weld schedule contains the function WAIT nnn CY FOR PRESSURE SWITCH, and this input does not become active in the number of cycles specified, the control generates a PRESSURE SWITCH fault and continues with the schedule.

The control aborts the weld schedule and generates a PRESSURE SWITCH fault if the weld initiate is removed while the control is waiting in the function WAIT FOR PRESSURE SWITCH.

WELD PROCEED 1 Input   WP1
WELD PROCEED 2 Input   WP2

These two inputs can be used to force the processor to pause in a weld schedule and wait for an input to become active. These inputs are used in a weld schedule with Function #68, WAIT FOR WELD PROCEED INPUT. (The control will wait for the appropriate input before proceeding with the schedule.) If the initiate is removed before the input becomes active, the control generates a WELD PROCEED fault condition.

STEPPER RESET   SR

This input will reset all the steppers to Step 1 and the weld count to 0.

STEPPER RESET GROUP 1   SRG1
STEPPER RESET GROUP 2   SRG2

This input will reset all the steppers in Group 1 or 2 to Step 1 and the weld count to 0.

RETRACT PILOT #1 Input   **RT1**
RETRACT PILOT #2 Input   **RT2**

This input changes the state of the RETRACT VALVE #1 (or #2) output. How this output reacts to the RETRACT input depends on the settings established for the Retract Mode and Retract Cylinder setup parameters.

- When set to *UNLATCHED*, the RETRACT VALVE output follows the state of the RETRACT input. The valve output is active while the input is active.

- When setting *LATCHED* retract mode, the RETRACT input changes the state of the RETRACT VALVE output. The first pulse from the input activates the valve output. The second pulse from the input de-activates the output.

- With NONE selected, the control ignores the RETRACT input.

The Retract Cylinder setup parameter defines the retract cylinder as either AIR-NORMAL, or AIR-INVERTED, AIR/OIL-NORMALLY-OPEN or AIR/OIL-NORMALLY-CLOSED.

- AIR-NORMAL indicates that the output is turned **OFF** to close the gun.

- AIR-INVERTED indicates that the output is turned **ON** to close the gun.

- AIR/OIL-NORMALLY OPEN indicates that the output is turned **OFF** to close the gun.

- AIR/OIL-NORMALLY CLOSED indicates that the output is turned **ON** to close the gun.

For a detailed explanation of operation in retract, see "Retract Features" on page 7-12.

Output Definitions

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This section describes the output signals that the MedWeld 4000 control provides. At the right of the output names are abbreviations as they appear on the DEP-100S (Data Entry Panel).

Valve outputs may be output in two ways: *Binary* or *Discrete*. The type is set in I/O map **03 Valve Type**.

• When set *binary*, the output is the weighted value of the binary outputs. For example, 1 = BV1; 2 = BV2, 3 = BV1 + BV2 (because 1 + 2 = 3); 5 = BV4 + BV1 (1 + 4 = 5); etc.

• When set *discrete*, only one of six possible valves will be output for the sequence.

BINARY VALVE1/VALVE 1 Output	**V1**
BINARY VALVE2/VALVE 2 Output	**V2**
BINARY VALVE4/VALVE 3 Output	**V4**
BINARY VALVE8/VALVE 4 Output	**V8**
BINARY VALVE16/VALVE 5 Output	**V16**
BINARY VALVE32/VALVE 6 Output	**V32**

Turning on the discrete initiate for Valve #1, #2, #3, #4, #5 or #6 actuates the binary valve output 1, 2, 4, 8, 16 or 32, respectively.

NO FAULT Output   **NFLT**

This output is normally ON (to indicate that no fault conditions exist). If the control shuts down as the result of a fault condition, this output will be turned OFF.

FAULT Output   **FLT**

This output has only the FAULT state. The output is active HIGH when no fault conditions are detected.

If the control detects certain error conditions, this output becomes inactive until the fault is reset. To reset Fault or Alert conditions, press the ＊ key from the **Fault** display mode.

The Initiation On Fault setup parameter determines whether you can initiate a new weld sequence when a fault condition has been detected (and the FAULT output is active). For more information about this parameter, see page 5-10.

ALERT Output   ALT

This output is normally OFF. It turns ON to indicate an alert condition. Alert conditions are usually less serious than faults and are normally used to warn the operator that maintenance is required.

WELD / NO WELD Output   NWO

When the WELD/NO WELD input is opened, it energizes this output (to indicate that the control is in No Weld Mode). If a valid weld initiate is received while the control is in No Weld Mode, the weld schedule will schedule normally, but weld current will NOT flow.

WELD / NO WELD MISMATCH Output   WM

This output is active to indicate that the control is in Weld Mode and the data entry device is in No Weld Mode.

WELD IN PROGRESS Output   WIP

The control turns this output ON and OFF in response to the output control function. For more details, see "Output Control Functions" on page 4-9.

END OF HOLD Output   EWS

This output turns ON after the control completes the number of HOLD CYCLES programmed. The output remains active for the number of OFF CYCLES programmed. (For example, setting OFF CYCLES to 08 cycles holds this output active for 8 cycles.)

By disabling the OFF CYCLES (programming for 0 cycles), this output remains on for five cycles before it is turned off. The output remains on for a default interval of five cycles.

WELD COMPLETE Output   WCPL

This output is turned ON and OFF by the weld control in response to Functions #50 and #51.

READY TO WELD Output   RTW

When active, this output indicates that the control is ready to weld and will pass current if

- The control is in Weld Mode,
- NO faults exist,
- The CONTROL STOP input is HIGH,
- The WCU is synchronized with the line voltage,

- System cooling is provided: The SCR OVER TEMP input is closed

STEPPERS ARE RESET Output   SRST

This input resets all the steppers to Step 1 and the weld count to 0.

STEPPERS ARE RESET GROUP 1 Output   SRG1
STEPPERS ARE RESET GROUP 2 Output   SRG2

Either input will reset all the steppers in Group 1 or 2 to Step 1 and the weld count to 0.

END OF STEPPER Output   EOS

This output is active when the stepper completes the final weld in Step #5 of the profile. The program now issues the END OF STEPPER fault. Electrode maintenance is required.

END OF STEPPER GROUP 1 Output   ESG1
END OF STEPPER GROUP 2 Output   ESG2

Either output is active when the stepper completes the final weld in Step #5 of the stepper profile for Group 1 or 2. The program now issues the END OF STEPPER fault. Electrode maintenance is required.

STEPPER APPROACHING MAX Output   SALT

This output is turned ON when any assigned active stepper assigned to one of these groups has entered Step 5.

STEPPER APPROACHING MAX GROUP 1 Output SAG1
STEPPER APPROACHING MAX GROUP 2 Output SAG2

Either output is turned ON when any assigned active stepper assigned to one of these groups has entered Step 5.

PRESSURE SELECT 1 Output   PS1
PRESSURE SELECT 2 Output   PS2
PRESSURE SELECT 3 Output   PS3
PRESSURE SELECT 4 Output   PS4

These outputs are activated or de-activated when the MedWeld 4000 executes functions #56 (TURN ON PRESSURE SELECT #n) and #57 (TURN OFF PRESSURE SELECT #n).

INTENSIFICATION VALVE Output   INTV

This output energizes the TURN ON INTENSIFY VALVE some time after the gun closes and builds up initial pressure.

INITIATION ACKNOWLEDGE Output   IACK

This output indicates that the control is executing a schedule.

RETRACT Output 1   RV1
RETRACT Output 2   RV2

These outputs respond to the on/off status of the RETRACT VALVE 1and 2 PILOT Inputs, based on the Retract Mode setup parameter. Refer to page 5-11 for more details.

For a detailed explanation of operation in retract, refer to "Retract Features" on page 7-12.

Other I/O: Program T02300

Program T02300 also includes the following inputs and outputs:

FieldBus Inputs: **TIP DRESS Input**

This input will reset the stepper to step #2 and decrement the Tip Dresses Remaining counter.

When this input becomes active, the control also resets the TIP DRESS REQUEST output.

DOOR INTERLOCK

This input monitors the state of a door interlock. If this input goes low, it acts like a CONTROL STOP input.

USER INPUT (1 - 8)

These inputs can be used to force the weld processor to wait in a weld schedule using the user input functions.

CONTACTOR (1 - 4) SHORT Input

The program sequentially fires 4 CONTACTOR SELECT inputs to the inverter. If a fault is detected in a contactor, a CONTACTOR NOT IN WHEN NEEDED fault will be generated.

CONTACTOR SELECT (1 - 4) AUX Input

This is the Isolation contactor auxiliary contacts input for mutiple contactors.

AUXILLARY COOLING Input

This is an auxiliary cooling input. It acts like a SYSTEM COOLING input.

STEPPER AUX WELD COUNTER RESET

Attached to each linear stepper is an *auxiliary weld counter.* When a stepper increments, its auxiliary weld counter also increments. When this counter reaches the programmed value for the Aux. Counter Max Counts = nnnnn stepper parameter, the AUX. COUNTER AT MAX output will be turned on.

Setting the STEPPER AUXILIARY COUNTER RESET input HIGH resets all the steppers' auxiliary weld counters. The existing STEPPER RESET input also will reset the counters.

You can view and modify the stepper's auxiliary weld counter. It is available on the Stepper Status display of the DEP-100S (Hand-Held Terminal).

FieldBus Outputs:

WELD MODE ON

This is an output to confirm that the control is in Weld mode.

NO ALERT

This output is normally ON. It turns OFF to indicate an alert condition. Alert conditions are usually less serious than faults and normally serve to warn the operator that maintenance is required.

TIP DRESS REQUEST

The control activates this output when the stepper reaches the first weld in Step #3, the Max Tip Dresses setup parameter is greater than 0 AND the caps have NOT been dressed the maximum allowable number of times.

CONTACTOR SELECT (1 - 4)

This output selects which inverter SCR to switch on, when firing multiple SCRs in the inverter.

ISOC IS OPEN

This is a status output that shows the status of the isolation contactor. If it is open, this output is activated.

DUTY CYCLE LIMIT

This an inverter fault. The inverter is rated to deliver the full current according to the inverter type:

- **Type 1:** Full current is rated for firing up to 30 out of 300 cycles (10 % duty cycle).

- **Type 1:** Full current is rated for firing up to 42 out of 210 cycles (20 % duty cycle).

Exceeding the respective duty cycle generates this fault. After this fault occurs, the inverter must be de-rated.

AUX WELD COUNTER AT MAX

When a stepper increments, its Auxiliary Weld Counter also increments. When this counter reaches the programmed value for the Aux. Counter Max Counts = nnnnn setup parameter, the STEPPER AUXILIARY COUNTER AT MAXIMUM output will be turned on.

When programming Aux. Counter Max Counts to 00000, the output is disabled. Setting the AUX. COUNTER RESET input HIGH resets all of the steppers' auxiliary weld counters. The existing STEPPER RESET input also will reset the counters.

Discrete Inputs:

TIP DRESS

This input will reset the stepper to step #2 and decrement the Tip Dresses Remaining counter.

When this input becomes active, the control also resets the TIP DRESS REQUEST output.

DOOR INTERLOCK

This input monitors the state of a door interlock. If this input goes low, it acts like a CONTROL STOP input.

USER INPUT (1 - 8)

These are generic inputs from the SLC. These inputs can be used to force the weld processor to wait in a weld schedule using the user input functions.

CONTACTOR (1 - 4) SHORT Input

The program sequentially fires 4 CONTACTOR SELECT inputs to the inverter. If a fault is detected in a contactor, a CONTACTOR NOT IN WHEN NEEDED fault will be generated.

SELECT (1 - 4) AUX Input

This is the Isolation contactor auxiliary contacts input for multiple contactors.

AUXILLARY COOLING Input

This is an auxiliary cooling input. It acts like a SYSTEM COOLING input.

STEPPER AUX WELD COUNTER RESET

Attached to each linear stepper is an *auxiliary weld counter*. When a stepper increments, its auxiliary weld counter also increments. When this counter reaches the programmed value for the Aux. Counter Max Counts = nnnnn stepper parameter, the AUX. COUNTER AT MAX output will be turned on.

Setting the STEPPER AUXILIARY COUNTER RESET input HIGH resets all the steppers' auxiliary weld counters. The existing STEPPER RESET input also will reset the counters.

You can view and modify the stepper's auxiliary weld counter. It is available on the Stepper Status display of the DEP-100S (Hand-Held Terminal).

Discrete Outputs:

WELD MODE ON

This output confirms that the control is in Weld mode.

CONTACTOR SELECT (1 - 4)

This output selects which inverter SCR to switch on, when firing multiple SCRs in the inverter.

TIP DRESS REQUEST

The control activates this output when the stepper reaches the first weld in Step #3, the Max Tip Dresses setup parameter is greater than 0 AND the caps have NOT been dressed the maximum allowable number of times.

ISOC IS OPEN

This is a status output that shows the status of the isolation contactor. If the isolation contactor is open, this output is activated.

DUTY CYCLE LIMIT

This an inverter fault. The inverter is rated to deliver the full current according to the inverter type:

- **Type 1:** Full current is rated for firing up to 30 out of 300 cycles (10 % duty cycle).

- **Type 1:** Full current is rated for firing up to 42 out of 210 cycles (20 % duty cycle).

Exceeding the respective duty cycle generates this fault. After this fault occurs, the inverter must be de-rated.

AUX WELD COUNTER AT MAX

When a stepper increments, its Auxiliary Weld Counter also increments. When this counter reaches the programmed value for the Aux. Counter Max Counts = nnnnn setup parameter, the STEPPER AUXILIARY COUNTER AT MAXIMUM output will be turned on.

When programming Aux. Counter Max Counts to 00000, the output is disabled. Setting the AUX. COUNTER RESET input HIGH resets all of the steppers' auxiliary weld counters. The existing STEPPER RESET input also will reset the counters.

Input/Output Mappings (T02300)

. . . .

Program T02400 (using the Type 1 inverter) has I/O mappings for use
with the FieldBus (*Profibus*) and Discrete I/O communication schemes.

Input Abbreviations   On the LCD panel of the MedWeld 4000 or DEP-100S, the FieldBus
and Discrete inputs appear with these abbreviations:

```
BINARY SELECT 1 / Pilot 1 ..................................BS1
BINARY SELECT 2 / Pilot 2 ..................................BS2
BINARY SELECT 4 / Pilot 3 ..................................BS4
BINARY SELECT 8 / Pilot 4....................................BS8
BINARY SELECT 16 / Pilot 5..................................BS16
BINARY SELECT 32 / Pilot 6 ................................BS32
WELD INITIATE ...................................................INT
WELD / NO WELD ...............................................WLD
ISOLATION CONTACTOR SAVER ........................CSVR
FAULT RESET .......................................................FR
NO STROKE / NO WELD Input.............................NSNW
PROGRAM SECURITY Input ................................PSEC
HEAT DISPLAY SECURITY Input .........................HSEC
PRESSURE SWITCH Input....................................PS1
WELD PROCEED 1...............................................WP1
WELD PROCEED 2...............................................WP2
STEPPER RESET .................................................SR
STEPPER RESET GROUP 1.................................SRG1
STEPPER RESET GROUP 2.................................SRG2
TIP DRESS ...........................................................TIPD
DOOR INTERLOCK ..............................................DLCK
RETRACT PILOT 1 ...............................................RT1
RETRACT PILOT 2 ...............................................RT2
USER INPUT 1......................................................UI1
USER INPUT 2......................................................UI2
USER INPUT 3......................................................UI3
USER INPUT 4......................................................UI4
USER INPUT 5......................................................UI5
USER INPUT 6......................................................UI6
USER INPUT 7......................................................UI7
USER INPUT 8......................................................UI8
CONTACTOR 1 SHORT Input ..............................SHT1
CONTACTOR 2 SHORT Input ..............................SHT2
CONTACTOR 3 SHORT Input ..............................SHT3
CONTACTOR 4 SHORT Input ..............................SHT4
CONTACTOR SELECT 1 AUX Input ....................CSI1
CONTACTOR SELECT 2 AUX Input ....................CSI2
CONTACTOR SELECT 3 AUX Input ....................CSI3
CONTACTOR SELECT 4 AUX Input ....................CSI4
AUXILLARY COOLING Input ................................TROT
STEPPER AUX WELD COUNTER RESET .........SACR
NONE
```

Output Abbreviations

On the LCD panel of the MedWeld 4000 or DEP-100S, the FieldBus and Discrete outputs appear with these abbreviations:

VALVE1 / BINARY VALVE 1	V1
VALVE2 / BINARY VALVE 2	V2
VALVE3 / BINARY VALVE 4	V4
VALVE4 / BINARY VALVE 8	V8
VALVE5 / BINARY VALVE 16	V16
VALVE6 / BINARY VALVE 32	V32
NO FAULT Output	NFLT
FAULT Output	FLT
ALERT Output	ALT
WELD MODE ON	WMON
WELD / NO WELD MISMATCH Output	WM
WELD IN PROGRESS	WIP
NO ALERT Output	NALT
WELD COMPLETE	WCPL
READY TO WELD	RTW
STEPPERS ARE RESET	SRST
STEPPERS ARE RESET GROUP 1	SRG1
STEPPERS ARE RESET GROUP 2	SRG2
END OF STEPPER	EOS
END OF STEPPER GROUP 1	ESG1
END OF STEPPER GROUP 2	ESG2
STEPPER APPROACHING MAX	SALT
STEPPER APPROACHING MAX GROUP 1	SAG1
STEPPER APPROACHING MAX GROUP 2	SAG2
TIP DRESS REQUEST	TIPD
PRESSURE SELECT 1	PS1
PRESSURE SELECT 2	PS2
PRESSURE SELECT 3	PS3
PRESSURE SELECT 4	PS4
INITIATION ACKNOWLEDGE Output	IACK
RETRACT 1	RV1
RETRACT 2	RV2
CONTACTOR SELECT 1	CSO1
CONTACTOR SELECT 2	CSO2
CONTACTOR SELECT 3	CSO3
CONTACTOR SELECT 4	CSO4
ISOC IS OPEN	IC
DUTY CYCLE LIMIT	DUTY
AUX WELD COUNTER AT MAX	SACM
NONE	

Input/Output Mappings (T03300)

. . . .

Program T03300 (for AC controls) includes input/output mappings for use with the FieldBus (*Profibus*) and DIO (Discrete I/O) communication systems.

Input Abbreviations

On the LCD panel of the MedWeld 4000 or DEP-100S, the FieldBus and Discrete inputs appear with these abbreviations:

```
BINARY SELECT 1 / Pilot 1 ...................................BS1
BINARY SELECT 2 / Pilot 2 ...................................BS2
BINARY SELECT 4 / Pilot 3 ...................................BS4
BINARY SELECT 8 / Pilot 4....................................BS8
BINARY SELECT 16 / Pilot 5..................................BS16
BINARY SELECT 32 / Pilot 6 .................................BS32
WELD INITIATE ....................................................INT
WELD / NO WELD .................................................WLD
ISOLATION CONTACTOR SAVER ........................CSVR
FAULT RESET ........................................................FR
TRANSFORMER OVERTEMP Input .....................TROT
NO STROKE NO WELD Input ...............................NSNW
PROGRAM SECURITY Input ................................PSEC
HEAT DISPLAY SECURITY Input ........................HSEC
PRESSURE SWITCH Input....................................PS1
WELD PROCEED 1...............................................WP1
WELD PROCEED 2...............................................WP2
STEPPER RESET ..................................................SR
STEPPER RESET GROUP 1 .................................SRG1
STEPPER RESET GROUP 2 .................................SRG2
RETRACT PILOT 1 ...............................................RT1
RETRACT PILOT 2 ...............................................RT2
NONE
```

Output Abbreviations

On the LCD panel of the MedWeld 4000 or DEP-100S, the FieldBus and DiscreteDiscrete outputs appear with these abbreviations:

```
VALVE1 / BINARY VALVE 1  ................................. V1
VALVE2 / BINARY VALVE 2  ................................. V2
VALVE3 / BINARY VALVE 4  ................................. V4
VALVE4 / BINARY VALVE 8  ................................. V8
VALVE5 / BINARY VALVE 16  .............................. V16
VALVE6 / BINARY VALVE 32  .............................. V32
NO FAULT Output ............................................... NFLT
FAULT Output ..................................................... FLT
ALERT Output ..................................................... ALT
WELD / NO WELD ............................................... NWO
WELD / NO WELD MISMATCH Output ............... WM
WELD IN PROGRESS ......................................... WIP
END OF HOLD Output ......................................... EWS
WELD COMPLETE .............................................. WCPL
READY TO WELD  ............................................... RTW
STEPPERS ARE RESET  ..................................... SRST
STEPPERS ARE RESET GROUP 1  .................... SRG1
STEPPERS ARE RESET GROUP 2  .................... SRG2
END OF STEPPER ............................................... EOS
END OF STEPPER GROUP 1  ............................. ESG1
END OF STEPPER GROUP 2  ............................. ESG2
STEPPER APPROACHING MAX ......................... SALT
STEPPER APPROACHING MAX GROUP 1 ........ SAG1
STEPPER APPROACHING MAX GROUP 2 ........ SAG2
PRESSURE SELECT 1  ........................................ PS1
PRESSURE SELECT 2  ........................................ PS2
PRESSURE SELECT 3  ........................................ PS3
PRESSURE SELECT 4  ........................................ PS4
INTENSIFICATION VALVE Output ........................ INTV
INITIATION ACKNOWLEDGE Output  .................. IACK
RETRACT 1 ......................................................... RV1
RETRACT 2 ......................................................... RV2
NONE
```

Setting the Word Size

On the DEP-100S, you can specify the word size for I/O in either FieldBus or DeviceNet communications. Do this under the **Program** menu and **I/O Mapping** option.

Set the word size for one of these choices:

- **0** disables communications.

- **1** sets the word size to 16 inputs or 16 outputs, to supply one discrete I/O board.

- **2** sets the word size to 32 inputs or 32 outputs, to supply two discrete I/O boards.

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Weld Schedules 4

The MedWeld 4000 control is a full-function device, capable of storing up to 99 unique weld schedules. Each weld schedule can then be assigned to one of 99 independent steppers.

Several methods are available to program the weld processor. Refer to "Programming the Weld Processor" on page 2-12 for more information, or refer to the documentation provided with each programming device.

This chapter does not describe how to create or modify a weld schedule. (These steps will depend on the programming device.) This chapter only describes all of the weld functions available for use in programming a weld schedule.

What is a Weld Schedule?
. . . .

A weld *schedule* is a list of commands that the control is to execute. For example, to perform a simple spot weld, you might use a weld schedule consisting of the following functions:

```
LINEAR STEPPER #2 ASSIGNED
TURN ON WELD VALVE #1
TURN ON ISOLATION CONTACTOR
SQUEEZE 20 CYCLES
WELD 10 CY 50% I
HOLD 02 CYCLES
WAIT FOR NO INITIATE IF FAULT
TURN OFF WELD VALVE #1
TURN OFF ISOLATION CONTACTOR
```

Software Capabilities

. . . .

The MedWeld 4000 provides commands for:

- Assigning a schedule to a stepper,

- Defining the type of stepper to use (linear or SureWeld),

- Turning selected outputs on or off and

- Providing weld current.

Other functions enable

- Overriding the setup parameters,

- Controlling the I/O by monitoring inputs and activating outputs,

- Regulating weld current to fall within a prescribed range, and repeat the weld if the current is not within that range,

- Statistical process control (SPC) functions,

- Selecting the firing mode (to assure consistent voltage or to assure constant secondary current) and

- Pausing in a schedule to wait for certain operating conditions to become true.

You can add functions from this list, or delete functions from it. You may also change any of the numeric values specified in a function. This lets you create a schedule that meets your application requirements.

The following sections describe the functions available for use in a weld schedule, including the two-digit function code and the action each function produces.

The functions are grouped according to their purpose in a weld schedule, and to aid your understanding their overall interaction. To see these groupings, refer to "Quick Reference" on page 4-24.

List of Functions

. . . .

NOTE: *Unless otherwise indicated, **nn** represents any two-digit number from 0 – 99. **nnn** is a 3-digit number from 0 – 999. Exceptions to this convention will appear next to the function.*

Delay Functions

Delay functions all have the same effect on the weld schedule: They cause the control to wait for the number of cycles specified. (Different names are assigned for describing the reasons for a delay.)

During these functions, weld current does not flow and I/O status is not changed.

01	SQUEEZE nn CYCLES
02	COOL nn CYCLES
03	HOLD nn CYCLES
04	OFF nn CYCLES
05	INITIAL SQUEEZE nn CYCLES
07	WAIT nn CYCLES

Weld Functions and Firing Modes

Weld functions provide a specified amount of weld current for the number of cycles programmed. The function selected also selects the type of firing mode desired.

The weld function you select also tells the weld processor the type of firing mode to use to control the energy provided to a weld. Specify weld current as either

• A percentage of maximum available current, or

• The amount of secondary current.

This function tells the control how to compensate for changes in the welding environment:

• **AC operation: *%I*** uses a feature called ***Automatic Voltage Compensation***. AVC monitors *primary voltage*, using a nominal voltage reference point (programmed in the setup parameters) to determine when compensation is required for voltage swings on the weld bus. This method does NOT compensate for changes in the welder secondary circuit.

• **AC operation: *Automatic Current Compensation*.** ACC monitors the *current* during each cycle. It compensates for changes detected during the next cycle, to maintain secondary current at the level programmed.

- **MFDC operation:** High-frequency DC welding has the following characteristic differences from conventional single-phase welding:

  - There is *essentially no power factor or impedance* in high-frequency welding that corresponds to the power factor issues of AC welding. The power factor is high and constant, and the weld transformer's secondary circuit is direct current (DC).

  - The welding transformer depends on the applied voltage and circuit resistance. It is generally independent of the magnetic effects of the secondary circuit. (Magnetic material in the secondary is not a consideration.)

  - Given a constant applied voltage, the weld current depends primarily on the resistance of the weld itself. (Welds with different resistances will result in different weld current.)

Functions using the AVC firing mode specify weld current as nn%I (representing the *percentage of maximum available* current). Functions using the ACC firing mode specify a set amount of *secondary current*, displayed as **nnnn0 AMPS**.

Caution:
The Transformer Turns Ratio setup parameter (described on page 5-14) must be accurately programmed for the control to supply the correct amount of secondary current in ACC firing mode.

NOTE: *The weld data generated by the control (and displayed at the DEP or a data monitoring device) does* NOT *include every function that provides weld current. Keep this in mind when programming a weld schedule. Only the following functions are included in the Weld Data display:*

AVC Firing Mode (%I)

20	WELD nn CY mm %I *
21	TEMPER nn CY mm %I
22	PREHEAT nn CY mm %I
23	POSTHEAT nn CY mm %I
24	PRE-WELD nn CY mm %I
25	WELD nn CY mm.m %I *
26	WELD nn HALF CYCLES mm.m %I *

* The stepper is active during this function. Functions #20–26 select the AVC firing mode.

NOTE: *For all weld functions,* **mm** *= 20 – 99. (The processor can fire a range from 20% to 99% I.) For half-cycle functions, the range is from 20.0% to*

99.9% I. AVC faults may occur when the control is firing at or near the upper and lower limits (20 and 99%).

WELD 20 CY 60%I

%I

99%

60%I

20%

20 cycles   Time (Cycles)
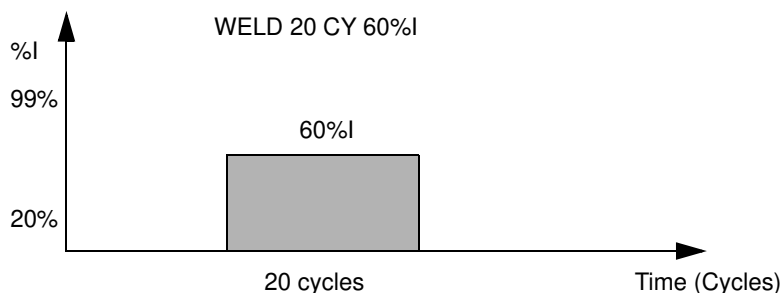
NOTE: *When Function #60 appears before any weld function in a schedule, the control displays **IMP** (impulses) rather than **CY** (cycles) to indicate the weld control will **pulsation** weld. Refer to Function #60 on page 4-7 for more information.*

Automatic Current Compensation Firing Mode

The following weld functions will select the Automatic Current Compensation (ACC) firing mode.

30	WELD nn CY nnnn0 AMPS*
31	TEMPER nn CY nnnn0 AMPS
32	PREHEAT nn CY nnnn0 AMPS
33	POSTHEAT nn CY nnnn0 AMPS
34	PRE-WELD nn CY nnnn0 AMPS
38	WELD nnn IMP nnnn0 AMPS nnnn0 AMPS

* The stepper is active during this function.

WELD 20 CY 05000 AMPS

Secondary current (A.)

05000 A.

20 cycles   Time (Cycles)
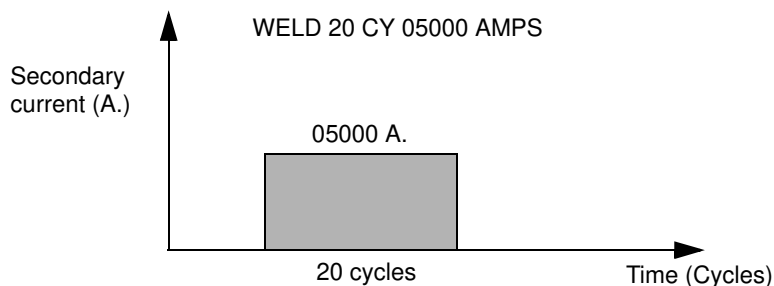
NOTES: *ACC faults may occur when the control is firing at or near the high and low range of current. The current range for each control is unique and depends on factors such as the size of the weld transformer. Experiment with the control to determine the upper and lower range of current each control can provide.*

*When Function #60 appears before any weld function in a schedule, the control displays IMP (impulses) rather than CY (cycles) to indicate that the weld control will **pulsation** weld. See Function #60 on page 4-7 for more information.*

When monitoring secondary current, the minimum "no-weld" current for the selected current range will be used for ACC and stepper increment. This is versus the 16 A. no-weld current used when monitoring primary current. The SCIB minimum "no-weld" cycle currents for 25 kA., 50 kA. and 100 kA. jumper settings are 300, 600 and 1,200 A., respectively.

Other Functions Controlling Weld Current

Note: For all weld functions, *mm* = 20 – 99. The processor can fire a range from 20% to 99% I.

40	SLOPE nn CY mm %I TO mm %I
45	SLOPE nn CY nnnn0 AMPS TO nnnn0 AMPS

These functions provide weld current that starts at the first value and increases or decreases linearly to the second value over the number of cycles specified. Function #40 uses AVC firing mode. Function #45 uses ACC firing.

Either function will fire for the number of cycles specified. For example, the function

40   SLOPE 30 CY 45% I TO 65% I

tells the control to fire one cycle at 45% of the maximum available current. Then, over the next 29 cycles, gradually increase the heat provided to 65%.

NOTE: *The processor can fire a range from 20% to 99% I. AVC faults may occur when firing at or near these ranges.*
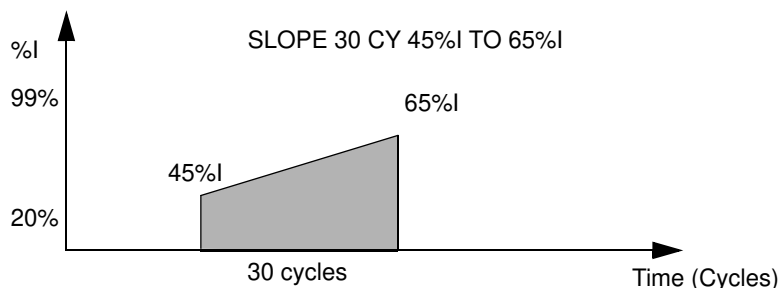
However, by defining the slope as an *impulse* (Function #60 appears before this function in the schedule), the weld processor gradually increases the energy provided by each impulse, until it has sloped to the desired energy.

For example, the following two functions will have the action shown in the diagram below:

```
%I                IMPULSE=03 HEAT CY, 08 COOL CY
                  SLOPE 03 IMP 40%I TO 50%I
99%

                                       50%
                              45%
                    40%
20%
           3cy    8cy   3cy   8cy   3cy          Time (Cycles)
```
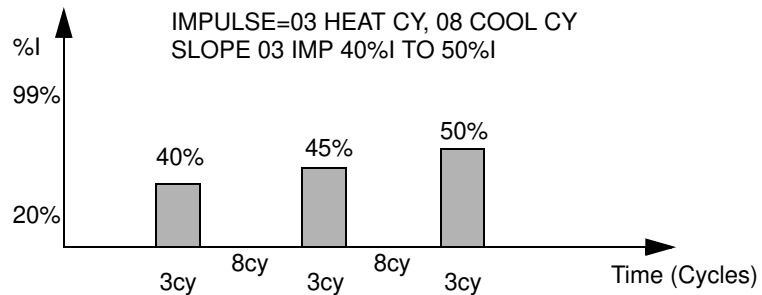
60   IMPULSE= nn HEAT CY, nn COOL CY *(nn=1-99)*

This function defines the length of a weld impulse. It tells the weld processor that the next function in the schedule should pulsation weld (providing heat cycles followed by cool cycles, rather than just heat cycles).

When this function appears before any weld function, the control displays IMP (impulse) rather than CY (cycles) to indicate the weld control will pulsation weld.

Pulsation welding provides a specified number of impulses. (An impulse is a number of heat cycles—when weld current flows—followed by a number of cycles when current does not flow.) Consider the following schedule:

60   IMPULSE = 10 HEAT CY, 10 COOL CY
20   WELD 04 IMP 65%I

In this example, the weld processor will actually fire for 10 cycles at 65% heat, then wait for 10 cycles with NO heat, *and repeat this pattern 4 times*.

```
%I        IMPULSE=10 HEAT CY, 10 COOL CY
99%       WELD 04 IMP 65%I

          65%

20%
     10cy  10cy  10cy  10cy  10cy  10cy  10cy  10cy    Time (Cycles)
```
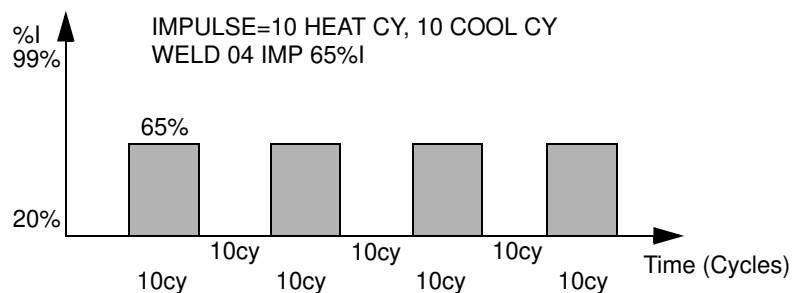
This function only affects the next function in a weld schedule. It should appear before every weld or slope function you want to pulsation weld in the schedule.

74   WELD nnn IMP mm %I HIGH mm %I LOW
            (nn=1-999 mm=20-99)

Function #74 enables welding at two different heat settings. It MUST immediately follow Function #60 (which defines the length of the impulse) in the weld schedule.

The control uses the first current setting (nn %I HIGH) for the heat cycles of the impulse. The second heat setting (nn %I LOW) defines the amount of heat to provide during the cool cycles of an impulse.

The cool cycles actually fire at a reduced % heat. For example, the following schedule will have the action illustrated here:

IMPULSE=10 HEAT CY, 10 COOL CY
WELD 004 IMP 75%I HIGH 40%I LOW
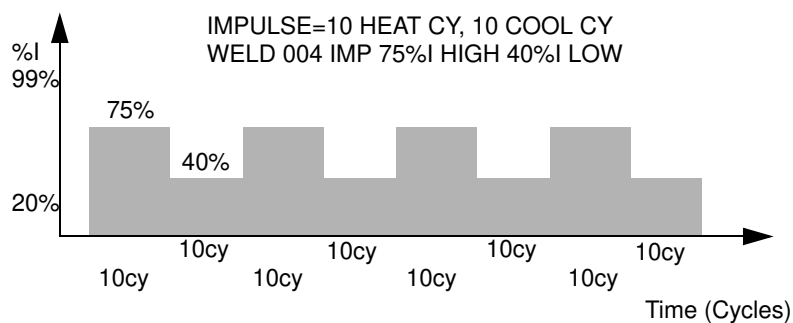
Output Control Functions

Note: These functions require certain outputs. Before programming these functions, check the packet of drawings that came with your control for I/O availability.

These functions allow the control to turn outputs on or off within a weld schedule:

50   TURN ON WELD COMPLETE
51   TURN OFF WELD COMPLETE
52   TURN ON ISOLATION CONTACTOR
53   TURN OFF ISOLATION CONTACTOR
54   TURN ON VALVE #n *(n = 1-6)*
55   TURN OFF VALVE #n *(n = 1-6)*
56   TURN ON PRESSURE SELECT #n *(n = 1-4)*
57   TURN OFF PRESSURE SELECT #n *(n = 1-4)*
58   TURN ON WELD IN PROGRESS
59   TURN OFF WELD IN PROGRESS
63   TURN ON OUTPUT #n *(n = 1-8)*
64   TURN OFF OUTPUT #n *(n = 1-8)*

NOTES: *The function* TURN ON WELD COMPLETE *will only activate the* WELD COMPLETE *output under the following conditions: There are no active fault conditions,* AND *the* BINARY SELECT *or* WELD INITIATE *inputs are still active.*

*Function #52 (*TURN ON ISOLATION CONTACTOR*) will first check to determine if the isolation contactor is already closed, and will pull in the isolation contactor only if it is open. This is designed to improve the process speed, bypassing the delay provided to wait for the isolation contactor to close.*

Input Monitoring
Functions

Note: These functions require certain inputs. Before programming these functions, check the packet of drawings that came with your control for I/O availability.

68	WAIT nnn CY FOR PRESSURE SWITCH INPUT
69	WAIT FOR PRESSURE SWITCH INPUT
70	WAIT nnn CY FOR WELD PROCEED INPUT
71	WAIT FOR WELD PROCEED INPUT
72	WAIT nnn CY FOR LINE > nnn VOLTS
73	WAIT FOR LINE > nnn VOLTS
79	WAIT nnn CY FOR SYSTEM COOLING

These functions tell the control to check the status of an input. They wait either indefinitely for an input to be active, or wait for only a specified number of cycles for the input to be active.

If the input does not become active within the specified delay, the processor generates the appropriate fault condition, as listed below. (The wait functions with no programmable delay will abort the schedule and generate the fault if the initiate is removed while the weld processor is waiting.)

- Functions #68 and #69: PRESSURE SWITCH fault. Function #68 waits in the sequence for up to the specified number of cycles, **nnn**. Function #69 waits indefinitely.

  Function #68 continues the sequence in No Weld mode to inhibit weld current from flowing if the Pressure Switch setup parameter is programmed as a FAULT. If programming this parameter as an ALERT, it continues with the sequence as normal.

- Functions #70 and #71: WELD PROCEED fault. Function #70 pauses and waits for up to the specified number of cycles **nnn** for the WELD PROCEED input to become active. Function #71 operates the same way, but will wait indefinitely.

  Function #70 continues the sequence in No Weld mode to inhibit weld current from flowing if the Weld Proceed setup parameter is programmed as a FAULT. If this parameter is programmed as an ALERT, it continues with the sequence as normal.

- Functions #72 and 73: INSUFFICIENT LINE VOLTAGE fault. Function #72 will wait in the sequence for up to the specified number of cycles, **nnn** for the WELD PROCEED input to become active. Function #73 waits indefinitely.

  Function #72 continues the sequence in No Weld mode to inhibit weld current from flowing if the Insufficient Line Voltage setup parameter is programmed as a FAULT. If programming this parameter as either an ALERT or NONE, it continues with the sequence as normal.

- Function #79: SYSTEM COOLING fault. (As a safety measure, the control cycles in No Weld to inhibit weld current from flowing.)

Caution:

DO NOT confuse the **label** used by the weld function (Input #1, for example) with an **actual input** position. That is, User Input #1 is NOT NECESSARILY assigned to input #1.

---

85   WAIT FOR NO INITIATE IF FAULT

This function tells the control to check if any faults exist. If the output is de-energized (a fault condition is present), the control waits 10 cycles in the weld schedule for the weld initiate to be removed. This function should appear after Function #78 (PROCESS WELD FAULTS) in the weld sequence.

If the initiate is still present after 10 cycles, the control uses the NO ZERO CROSSING SYNCHRONIZATION fault to indicate that a fault condition was active. (This is to prevent the control from performing a repeat of the sequence after receiving a FAULT RESET signal.)

Extend/Repeat
Functions

Note: These functions may require certain inputs. Before programming these functions, check the packet of drawings that came with your control for I/O availability.

75   EXTEND UNTIL NO INITIATE

This function tells the weld processor to monitor the status of the WELD INITIATE input, and to extend only *the previous function in the weld schedule* until it detects that the WELD INITIATE input is inactive.

This function is designed to monitor the status in the WELD INITIATE input and will extend the weld until the input is removed. In a standard application the weld will be extended until the Weld Complete (process complete) is seen. This then tells the robot or machine that it is okay to remove the initiate signal to the welding control and that the part is complete. If the initiate is dropped before that time, the welding control may issue the fault WELD INITIATE NOT PRESENT.

NOTE: An example of using an extend function is shown below in the following schedule of functions. *(Your application requirements may vary from this schedule, please use this as an example only.)*

```
START OF SCHEDULE #01
54          TURN ON VALVE #1
01          SQUEEZE 15 CYCLES
30          WELD 08 CY. 04000 AMPS
94          EXTEND UNTIL NO INITIATE
78          PROCESS WELD FAULTS
03          HOLD 02 CYCLES
55          TURN OFF VALVE #1
03          HOLD 10 CYCLES
END OF SCHEDULE #01
```

The bold text above for the extend function can be substituted with any extend in your software. It is important however that the EXTEND function is **immediately** after a weld function (as shown above) if you require the welding control to extend a weld.

62   REPEAT (AT NEXT FUNCTION)

This function also monitors the status of the weld initiate. When the control completes a weld schedule, it repeats the remaining functions in the schedule. At the end of the schedule, it returns to the REPEAT function, again checks the status of the WELD INITIATE input, and repeats the rest of the schedule. This continues *until* the processor detects that the WELD INITIATE input has been removed.

NOTE: *Functions #62 and #75 are mutually exclusive. They should* NOT *appear in the same sequence.*

94   EXTEND WELD IF LOW CURRENT LIMIT FAULT

This function tells the weld processor to automatically repeat the weld function if it detects a LOW CURRENT LIMIT fault.

This function must appear immediately after the weld function in the schedule. If it detects the LOW CURRENT LIMIT fault, the control restarts the weld function and generates the EXTEND WELD fault/alert condition.

The control will repeat the weld function above the extend *only once*. If the desired current is not provided on the re-weld, the control generates a LOW CURRENT LIMIT fault/alert condition.

NOTE: An example of using an extend function is shown below in the following schedule of functions. *(Your application requirements may vary from this schedule, please use this as an example only.)*

```
START OF SCHEDULE #01
54          TURN ON VALVE #1
01          SQUEEZE 15 CYCLES
30          WELD 08 CY. 04000 AMPS
94          EXTEND WELD IF LOW CURRENT LIMIT FAULT
78          PROCESS WELD FAULTS
03          HOLD 02 CYCLES
55          TURN OFF VALVE #1
03          HOLD 10 CYCLES
END OF SCHEDULE #01
```

The bold text above for the extend function can be substituted with any extend in your software. It is important however that the EXTEND function is **immediately** after a weld function (as shown above) if you require the welding control to extend a weld.

95   EXTEND WELD IF CURRENT LESS THAN nnnn0 AMPS

This function has the same result as Function #94, but monitors *secondary current* instead of the LOW CURRENT LIMIT fault.

If the secondary current provided during the schedule does not reach the minimum value programmed, the control restarts the weld function and generates the EXTEND WELD fault or alert condition. The control will repeat the weld function above the extend *only once*. If the desired current is not provided on the re-weld, the control generates an EXTEND WELD fault.

NOTE: *When it is in No Weld mode, the control bypasses these Extend Weld functions. (The weld processor will not monitor the amount of current provided, because the control is in* No Weld.*)*

Stepper Assignment Functions

82	LINEAR STEPPER #nn ASSIGNED (0 = OFF)
83	SUREWELD STEPPER #nn ASSIGNED (0 = OFF)

(nn = 1-99)

Function #82 assigns a linear stepper to a weld schedule. Function #83 assigns a SureWeld stepper to a weld schedule.

The MedWeld 4000 can have up to 99 independent linear steppers, and up to 99 SureWeld steppers. Linear steppers have 5 programmable levels (called "steps") to provide additional energy. When either function appears in a weld schedule, the appropriate stepper is advanced (incremented) each time you execute the weld schedule.

If it is used in a weld schedule, either function MUST be the *first* function in the schedule.

Valid stepper numbers are 1 – 99. To disable a stepper for a schedule, assign the stepper as zero (#0). For more details about steppers, refer to Chapter 6, "Stepper Data".

86   TIP DRESS ADVANCE GROUP #nn STEP #m
(nn = 1-99 m = 1-5)

This function advances all the steppers assigned to the group number programmed in this function, to the step number specified in the function.

Suppose this function reads: TIP DRESS ADVANCE GROUP #02 STEP #05. Every stepper (1 – 99) assigned to group #02 would advance to Step #5.

NOTES: *This function can advance several steppers simultaneously. For example, your application may use several different weld schedules to execute a weld on the same tool, but those schedules may be assigned to different steppers (to account for weld variations).*

*This function allows you to advance every stepper assigned to a group each time **any** schedule finishes a weld. (Every time the electrodes weld, EVERY stepper involved is also advanced.)*

Program the group assignments using the Stepper Display provided from the DEP-100S. For more information, see "Linear Steppers" on page 6-1.

09   STEPPER MACH=nn PART=nn (0=OFF)

This function allows the user to assign two steppers to a schedule. The stepper additional currents are added together. One stepper is used as a machine stepper to adjust the heat for the machine. The other stepper is a part stepper and used to adjust the heat on an individual part. The part stepper can be reset by inserting Function #10 (below) in a separate schedule and executing the schedule after the part is complete.

10   RESET STEPPER nn

Executing this function resets the s specified stepper to the first step of the first group number.

Functions that Override Setup Parameters

The following functions allow setting programming limits that are unique to a given weld schedule. The new limits override the limits programmed in the setup parameters, and apply only to the weld schedule where they appear. They also take priority over any other limits established.

NOTE: *Refer to "Parameter Descriptions" on page 5-2 for detailed descriptions of these limit settings as programmed in the setup parameters.*

76	SEC. CURR LIMITS: HI=nnnn0 LOW=nnnn0
77	ISOLATION CONTACTOR DELAY=nn SEC
90	TRANSFORMER TURNS RATIO nnn:1 *(nnn=1-256)*
96	POWER FACTOR LIMIT: HI=nn% LOW=nn%
97	C-FACTOR LIMIT: HI=nnn LO=nnn
84	WINDOW: HI=+ nn% LO= -nn% C-FACTOR=nnn

This function permits defining a current limit window with high and low limit values. The action of this function is based on the firing mode used by the weld function: %I or Automatic Current Compensation. For further details of this feature, refer to "Dynamic Current Windows" on page 7-4.

Test Functions

39   TEST FIRE nn% CURRENT *(nn = 20-99)*

When it executes Function #39, the control will fire one cycle of weld current at the percentage of maximum available current programmed.

The control monitors and records both the actual current and the power factor during that cycle.

The control uses this test fire to determine the initial secondary resistance of the weld, and whether the electrodes tips were touching, based on current draw. Other functions (described below) also use the data generated by the test fire.

91   FAULT IF TIPS TOUCHING

This function generates a fault condition if the test fire from Function #39 (above) determined that the welding electrodes were touching.

These conditions must be true when using this function:

- Function #39 (TEST FIRE nn% CURRENT) MUST appear in the weld sequence.

- Function #91 must appear after the test fire function (#39) in the weld sequence.

- Function #92 (FAULT IF TIPS NOT TOUCHING) cannot appear in the weld sequence.

When it executes Function #39, the control monitors the actual weld current. If the control detected *more than* 10 A. primary current, it assumes that the electrode tips *were* touching and generates a TIPS TOUCHING fault.

Caution:
If Function #39 appears more than once in a sequence, the control uses the data from the most recently-executed test fire.

---

92   FAULT IF TIPS NOT TOUCHING

This function can generate a fault condition if the control determines that the welding electrodes are NOT touching.

These conditions MUST be true when using this function:

- Function #39 (TEST FIRE nn% CURRENT) must appear in the weld sequence.

- Function #92 must appear after the test fire function (#39) in the weld sequence.

- Function #91 (FAULT IF TIPS TOUCHING) cannot appear in the weld sequence.

When Function #39 executes, the actual weld current during that one cycle weld is monitored. If *less than* 10 A. primary current is detected, the control assumes that the electrode tips were NOT touching. It generates a TIPS NOT TOUCHING fault.

93 INITIAL PF LIMIT: HI=nn% LOW=nn%

This function is used to generate a fault condition if the initial power factor read during the test fire function (#39) does not fall within the high and low limits programmed in this function.

The following conditions must be true when using this function:

- Function #39 must appear in the weld schedule.

- This must appear after the test fire function (#39) in the weld schedule.

If the power factor read during the test fire was not within the range programmed, the control generates an INITIAL P.F. OUT OF RANGE fault.

98   GOTO SEQ #mm IF CURRENT LESS THAN nnnn0
            (mm = 1-99)

This function determines if the current provided during the weld portion of the schedule will be sufficient to make a good weld.

These conditions must be true when using this function:

- Function #39 must appear in the weld schedule and

- This function must appear after the test fire function (#39) in the weld schedule.

NOTE: *Function #98 may appear in a schedule more than once, to allow setting-up for different welding requirements.*

An example appears in the following schedule of functions. (This is NOT *a recommended weld schedule. Your application requirements may vary.)*

```
START OF SCHEDULE #01
54          TURN ON VALVE #1
01          SQUEEZE 15 CYCLES
39          TEST FIRE 25% CURRENT
98          GOTO SEQ#02 IF CURRENT LESS THAN 02500
98          GOTO SEQ#03 IF CURRENT LESS THAN 03500
30          WELD 08 CY. 04000 AMPS
03          HOLD 02 CYCLES
55          TURN OFF VALVE #1
03          HOLD 10 CYCLES
END OF SCHEDULE #01
```

When Function #39 executes, if the current detected is less then the value programmed, the control will jump to the GOTO schedule number to complete that weld schedule. (The control will not return to complete the original weld schedule.)

NOTES: *Phase shift during test fire will* NOT *vary by voltage compensation. The reported current will be extrapolated to what the value of current would have been delivered, using the following calculation:*

$$\textbf{Current Reported} = \frac{\text{Current Measured x Nominal Voltage}}{\text{Measured Voltage}}$$

This is implemented because the test fire is a single-cycle pulse, and the control is monitoring only changes in resistance (rather than changes in current).

80   VERIFY TIPS DOWN EVERY nn CY nn TIMES

This function lets you verify that the electrode tips are making full contact with the work piece, using the control's dynamic squeeze capabilities. Refer to "Dynamic Squeeze Features" on page 7-6.

During this function, the control fires one cycle of weld current at the percent entered for the Tips Down Test Fire setup parameter, then monitors the weld current provided and the power factor.

This is compared to the value programmed in the Tips Down Verified Current setup parameter (described on page 5-14). If the primary current detected *exceeds* the value programmed, the control proceeds to the next function in the weld schedule.

If the current is *less* than the value programmed, the control waits for the number of cycles programmed (nn CY), then repeats the test fire. This wait-and-fire process continues up to the programmed number of tries (nn TIMES).

If the current never reaches the value programmed, the control generates a TIPS NOT TOUCHING fault and schedules in No Weld. (Refer to "Dynamic Squeeze Features" on page 7-6.)

81   SLOW CYLINDER TEST EVERY nn CY nn TIMES

This function is similar to the previous function (VERIFY TIPS DOWN), but reports a different fault. It will schedule in Weld mode even when it detects a fault.

If the primary current detected by the control *exceeds* the Tips Down Verified Current: nnnn setup parameter, it proceeds to the next function in the weld schedule.

If the current is *less than* the setup parameter, the control waits the number of cycles programmed (nn CY), then repeats the test fire.

If the current never reaches the setup parameter limit, the control will continue the schedule in Weld mode, but generates a SLOW CYLINDER fault to indicate the condition.

Special Functions

78   PROCESS WELD FAULTS

This function provides a one-cycle delay in the weld schedule. It asks the MedWeld 4000 to indicate any faults that may have been generated so far in the schedule.

The control normally processes all fault conditions at the *end* of the weld schedule. This function allows forcing the control to process fault conditions before it completes the weld schedule. It should appear in the weld schedule BEFORE any functions that check fault status or require current weld data.

Cautions:

This function also causes the control to calculate the voltage, current and power factor averages and the C-factor for the weld. It also terminates the weld summary data collection, to assure the integrity of the weld data collected.

This function only processes the weld data: It does NOT update the FAULT and ALERT outputs. These outputs will be updated when the control executes the function TURN ON WELD COMPLETE OR at the end of the weld schedule.

This function will be executed only once by the processor. If it appears more than once in the schedule, it will be executed the **first** time it appears in the weld schedule.

---

89   VERIFY CYLINDER #n IS OUT OF RETRACT
(n = 1-2)

This function tells the control to check that the selected cylinder is out of retract. If the cylinder is NOT out of retract, the control will abort the schedule and generate a RETRACT PILOT fault.

61   ABORT IF NO INITIATE FOR nn CYCLES

This function tells the control to verify that the weld initiate has remained active. The control waits the number of cycles programmed while checking the initiates. If the initiates are not present at any time while it is waiting, the control will abort the sequence and generate the WELD INITIAT NOT PRESENT fault.

99   GOTO SEQ#nn *(nn = 1-99)*

This function is an unconditional jump to another weld schedule. It tells the control to stop the present weld schedule, and continue with the first function in another schedule.

This function can be used to save memory space in the control, by allowing multiple schedules to execute commonly-used functions.

The control considers the schedule *originally* initiated as the last schedule. The stepper assigned to the original schedule is also the only one incremented. This function should appear as the *last* function in a schedule, because the control will not return to the original schedule when it completes the new schedule.

Caution:
It is possible to create an infinite programming loop with Functions #98 (GOTO SEQ #nn IF CURRENT LESS THAN nnnn0 AMPS) and #99.

SPC Indexing Functions

The following functions permit collecting weld data for use in SPC (Statistical Process Control) Indexing. Refer to "SPC Indexing Capabilities" on page 7-8 for a detailed description of the control's SPC capabilities.

87   SET SPC OFFSET TO nn

This function establishes the starting bin number for SPC indexing. Bin #99 is the last usable bin. If the control reaches bin #99 and is still collecting data, data from each weld will be stored in bin #99 until a new offset is assigned. As a result, data accumulated in this bin is unsuitable for analysis.

NOTE: *This function does* NOT *tell the control to collect weld data. It only assigns a data storage bin number. Refer to the* Data Collection Sample Size *and* Data Collection Sample Frequency *setup parameters on page 7-9 for instructions on how to specify data collection.*

88   SEND ALL SAMPLES UNTIL NEXT SPC OFFSET

This function tells the control to start collecting weld data for all welds. This function should follow the SPC OFFSET function in the weld schedule because it is still necessary to assign a starting bin number.

Weld data collection continues until the control executes another schedule containing the SPC OFFSET function (without *this* function), to reset the global data collection process.

This function *overrides* the global Data Collection Sample Size and Data Collection Sample Frequency setup parameters described on page 7-9.

Caution:

This function is not designed for use in a normal
production run. It is intended for special situations
(such as tear-down) which require continuous
data collection.

NOTE: *There must be a MINIMUM of 5 cycles delay programmed after turning
ON any CONTACTOR SELECT prior to any weld current statement.*

Analog Pressure Control Functions

Program #T-03300 supports analog I/O through an analog card in the
control. To implement this support, four new functions have been added
to this version. For these functions, pressure channel #1 corresponds to
Analog card channel #0. Pressure channel #2 corresponds to Analog
card channel #1.

43   SET VALVE n CYLINDER RESSURE TO mm PSI
        (n = 1,2; m = 0–99)

This function sets the final pressure that the cylinder for either weld
gun must achieve before welding begins.

n is the weld gun number, either 1 or 2. Set the final pressure *mm* in
the range 0 – 99 PSI.

47   WAIT nn CYCLES FOR PRESSURE ACHIEVED
        (nn = 0–99)

This function tells the control to pause in a weld sequence until it
detects that the valve pressure programmed (in Functions #08, #13
and #14) has been achieved.

Set the number of cycles *nn* in the range 0 – 99.

If more than one valve pressure setting is in a sequence, this
function monitors only the *last* pressure function it sees.

If the valve pressure is not achieved after the programmed number
of cycles, the control generates a PRESSURE NOT ACHIEVED
condition. If the Pressure Not Achieved setup parameter is
programmed to generate a FAULT, the control continues with the
sequence in No Weld mode to inhibit weld current from flowing. If
programming this parameter as an ALERT or NONE, it continues
with the sequence as normal.

41   SET VALVE n TOUCH DOWN RESSURE TO mm PSI
(n = 1,2; m = 0–99)

This function sets a reduced "touch down" pressure for the weld gun to approach and initially touch the work pieces, prior to clamping them and applying the final pressure before welding. This prevents the weld gun from closing too fast and hard on the work pieces.

n sets the cylinder number: Either #1 or #2. Set the pressure *mm* in the range 0 – 99 PSI.

42   SET VALVE n TIP DRESS RESSURE (PSI)
(n = 1,2; m = 0–99)

This function sets a pressure for the specified weld gun that can be different from the welding or "touch down" pressure settings. This is used when running tip dress schedules.

n sets the cylinder number: Either #1 or #2. Set the pressure *mm* in the range 0 – 99 PSI.

Cascade Firing Board Support

Program #T03300 includes support for firing multiple contactors from a single-phase supply. A Cascade Firing Board (CFB) installed in the control implements this support. To execute this feature, the program includes Functions #48 and #49.

NOTE: *There must be a* MINIMUM *of 5 cycles delay programmed after turning* ON *any CONTACTOR SELECT prior to any weld current statement.*

48   TURN ON CONTACTOR SELECT #nn (*nn*=1-15)

This function selects the contactor number to enable for firing when attached to WTC's Cascade Firing Board in multi-contactor, single-phase applications. Set ***nn*** to be in the range 1 – 15.

Contactor enabling follows this sequence:

CONTACTOR SELECT #01 corresponds to CFB #1 firing board A;
CONTACTOR SELECT #02 corresponds to CFB #1 firing board B;
CONTACTOR SELECT #03 corresponds to CFB #1 firing board C;
CONTACTOR SELECT #04 corresponds to CFB #2 firing board A;

.
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.

CONTACTOR SELECT #15 corresponds to CFB #5 firing board C

This function waits 2 I/O scans to make sure the Discrete I/O board has updated its outputs, and waits 1 cycle so the Cascade Firing Board has time to switch.

You can select only one contactor at a time. If no contactor is selected in the sequence, the default firing board A on CFB #1 will be enabled.

This function should precede any stepper assignment function, current limits function, etc. in the sequence for each contactor.

This allows controlling each contactor individually.

49   TURN OFF CONTACTOR SELECT #nn (nn=1-15)

This function disables the contactor number that was enabled for firing using Function #10. It enables the default contactor on CFB #1 firing board A. Set ***nn*** in the range 1 – 15.

Function #11 compares the current to the current limits, increments the assigned stepper, etc. for the contactor #nn. It is not necessary to enter the Process Weld Faults function prior to this function, it is automatically executed.

NOTE: *If extend welding (*Reweld*) is required, you* MUST *insert the* PROCESS WELD FAULTS *function and the* EXTEND WELD *function prior to Function #11 in the sequence.*

Quick Reference

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The following list provides a quick reference for functions and the two-digit code assigned. They are grouped functionally:

Delay Functions (pg. 4-3)	01	SQUEEZE nn CYCLES
	02	COOL nn CYCLES
	03	HOLD nn CYCLES
	04	OFF nn CYCLES
	05	INITIAL SQUEEZE nn CYCLES
	07	WAIT nn CYCLES

AVC Firing Mode (pg. 4-4)	20	WELD nn CY/IMP mm %I*
	21	TEMPER nn CY/IMP mm %I
	22	PREHEAT nn CY/IMP mm %I
	23	POSTHEAT nn CY/IMP mm %I
	24	PRE-WELD nn CY/IMP mm %I
	25	WELD nn CY 00.0 %I
	26	WELD nn HALF-CYCLES 00.0 %I

ACC Firing Mode (pg. 4-5)	30	WELD nn CY/IMP nnnn0 AMPS*
	31	TEMPER nn CY/IMP nnnn0 AMPS
	32	PREHEAT nn CY/IMP nnnn0 AMPS
	33	POSTHEAT nn CY/IMP nnnn0 AMPS
	34	PRE-WELD nn CY/IMP nnnn0 AMPS
	36	WELD nn HALF-CYCLES nnnn0 AMPS
	38	WELD nnn IMP nnnn0 AMPS nnnn0 AMPS

Other Functions Providing Weld Current (pg. 4-6)	40	SLOPE nn CY (IMP) mm% TO mm% I
	45	SLOPE nn CY nnnn0 AMPS TO nnnn0 AMPS
	60	IMPULSE = nn HEAT CY, mm COOL CY
	74	WELD nnn IMP nn% HIGH nn% LOW

Output Control Functions (pg. 4-8)	50	TURN ON WELD COMPLETE
	51	TURN OFF WELD COMPLETE
	52	TURN ON ISOLATION CONTACTOR
	53	TURN OFF ISOLATION CONTACTOR
	54	TURN ON VALVE #n
	55	TURN OFF VALVE #n
	56	TURN ON PRESSURE SELECT #n
	57	TURN OFF PRESSURE SELECT #n
	58	TURN ON OUTPUT #n
	59	TURN OFF OUTPUT #n
	63	TURN ON WELD IN PROGRESS
	64	TURN OFF WELD IN PROGRESS

Input Monitoring Functions (pg. 4-9)	68	WAIT nnn CY FOR PRESSURE SWITCH INPUT
	69	WAIT FOR PRESSURE SWITCH INPUT
	70	WAIT nnn CY FOR WELD PROCEED INPUT
	71	WAIT FOR WELD PROCEED INPUT
	72	WAIT nnn CY FOR LINE > nnn VOLTS
	73	WAIT FOR LINE > nnn VOLTS
	79	WAIT nnn CY FOR SYSTEM COOLING
	85	WAIT FOR NO INITIATE IF FAULT

Extend/Repeat Functions (pg. 4-11)	62	REPEAT (AT NEXT FUNCTION)
	75	EXTEND UNTIL NO INITIATE
	94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
	95	EXTEND WELD IF CURRENT LESS THAN nnnn0 AMPS

Stepper Assignment Functions (pg. 4-13)	09	STEPPER MACH=nn PART=nn (0=OFF)
	10	RESET STEPPER nn
	82	LINEAR STEPPER #nn ASSIGNED (0 = OFF)
	83	SUREWELD STEPPER #nn ASSIGNED (0 = OFF
	86	TIP DRESS ADVANCE GROUP #nn STEP #m *(nn = 1-99 m = 1-5)*

Functions that Override Setup Parameters (pg. 4-14)	76	SEC. CURR LIMITS: HI=nnnn0 LOW=nnnn0
	77	ISOLATION CONTACTOR DELAY=nn SEC
	84	WINDOW: HI=+ nn% LO= -nn% C-FACTOR=nnn
	90	TRANSFORMER TURNS RATIO nnn:1 *(nnn=1-256)*
	96	POWER FACTOR LIMIT: HI=nn% LOW=nn%
	97	C-FACTOR LIMIT: HI=nnn LO=nnn

Test Functions (pg. 4-14)	39	TEST FIRE nn%I
	80	VERIFY TIPS DOWN EVERY 00 CY mm TIMES
	81	SLOW CYLINDER TEST EVERY 00 CY mm TIMES
	91	FAULT IF TIPS TOUCHING
	92	FAULT IF TIPS NOT TOUCHING
	93	INITIAL PF LIMIT: HI= nn% LOW = nn%
	98	GOTO SEQ#mm IF CURRENT LESS THAN nnnn0 *(mm = 1-99)*

Special Functions (pg. 4-19)	61	ABORT IF NO INITIATE FOR nn CYCLES
	78	PROCESS WELD FAULTS
	80	VERIFY TIPS DOWN EVERY nn CY. nn TIMES
	89	VERIFY CYLINDER #n IS OUT OF RETRACT *(n = 1-2)*
	99	GOTO SEQ #nn

| SPC Index Functions (pg. 4-20) | 87 | SET SPC OFFSET TO nn |
| | 88 | SEND ALL SAMPLES UNTIL NEXT SPC OFFSET |

Analog Pressure Control Functions (pg. 4-21)	43	SET VALVE n CYLINDER RESSURE TO mm PSI
	47	WAIT nn CYCLES FOR PRESSURE ACHIEVED
	41	SET VALVE N TOUCH DOWN RESSURE TO mm PSI
	42	SET VALVE n TIP DRESS RESSURE (PSI)

| CFB Support Functions (pg. 4-23) | 48 | TURN ON CONTACTOR SELECT #nn *(nn=1-15)* |
| | 49 | TURN OFF CONTACTOR SELECT #nn *(nn=1-15)* |

Default Weld Schedules in Program #T03300

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Following are the default sequences for program #T03300. Separate sequences apply to operation for a robot, welding machine and manual or portable welding gun. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Sequence: Robot

```
START OF SEQUENCE
82          LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76          SEC. CURR LIMITS: HI=00250 LO=99990
90          TRANSFORMER TURNS RATIO: 100:1
63          TURN ON VALVE #1
52          TURN ON ISOLATION CONTACTOR
01          SQUEEZE 30 CYCLES
30          WELD 10 CY. 00050 AMPS
78          PROCESS WELD FAULTS
03          HOLD 05 CYCLES
85          WAIT FOR NO INITIATE IF FAULT
55          TURN OFF VALVE #1
53          TURN OFF ISOLATION CONTACTOR
END OF SEQUENCE
```

Default Weld Sequence: Machine

```
START OF SEQUENCE
82          LINEAR STEPPER #00 ASSIGNED (0 = OFF)
76          SEC. CURR LIMITS: HI=00000 LO=99990
90          TRANSFORMER TURNS RATIO: 100:1
63          TURN ON OUTPUT #0
52          TURN ON ISOLATION CONTACTOR
01          SQUEEZE 30 CYCLES
30          WELD 10 CY. 00050 AMPS
78          PROCESS WELD FAULTS
03          HOLD 05 CYCLES
50          TURN ON WELD COMPLETE
64          TURN OFF OUTPUT #0
75          EXTEND UNTIL NO INITIATE
51          TURN OFF WELD COMPLETE
53          TURN OFF ISOLATION CONTACTOR
END OF SEQUENCE
```

Default Weld Sequence: Gun

```
START OF SEQUENCE
82          LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76          SEC. CURRENT LIMITS: HI=00000 LO= 99990
90          TRANSFORMER TURNS RATIO 100:1
54          TURN ON VALVE #1
05          INITIAL SQUEEZE 25 CYCLES
62          REPEAT (AT NEXT FUNCTION)
54          TURN ON VALVE #1
01          SQUEEZE 30 CYCLES
30          WELD 10 CY. 00050 AMPS
78          PROCESS WELD FAULTS
03          HOLD 05 CYCLES
55          TURN OFF VALVE #1
04          OFF 20 CYCLES
END OF SEQUENCE
```

Default Weld Schedules in Program #T02300

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Following are the default schedules for program #T02300. Separate schedules apply to operation for a robot, welding machine and manual or portable welding gun. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Schedule: Robot

```
START OF SCHEDULE
82        LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LOW=99990
90        TRANSFORMER TURNS RATIO: 073:1
63        TURN ON VALVE #1
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
10        TURN ON CONTACTOR SELECT #01
30        WELD 10 CY. 00050 AMPS
11        TURN OFF CONTACTOR SELECT #01
03        HOLD 05 CYCLES
85        WAIT FOR NO INITIATE IF FAULT
55        TURN OFF VALVE #1
53        TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Machine

```
START OF SCHEDULE
82        LINEAR STEPPER #00 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LO=99990
90        TRANSFORMER TURNS RATIO: 073:1
58        TURN ON WELD IN PROGRESS
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
10        TURN ON CONTACTOR SELECT #01
30        WELD 10 CY. 00050 AMPS
11        TURN OFF CONTACTOR SELECT #01
03        HOLD 05 CYCLES
10        TURN ON CONTACTOR SELECT #02
30        WELD 10 CY. 00050 AMPS
11        TURN OFF CONTACTOR SELECT #02
03        HOLD 05 CYCLES
10        TURN ON CONTACTOR SELECT #03
30        WELD 10 CY. 00050 AMPS
11        TURN OFF CONTACTOR SELECT #03
03        HOLD 05 CYCLES
10        TURN ON CONTACTOR SELECT #04
30        WELD 10 CY. 00050 AMPS
11        TURN OFF CONTACTOR SELECT #04
03        HOLD 05 CYCLES
50        TURN ON WELD COMPLETE
64        TURN OFF WELD IN PROGRESS
75        EXTEND UNTIL NO INITIATE
51        TURN OFF WELD COMPLETE
53        TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

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**Default Weld
Schedule: Gun**

START OF SCHEDULE
```
82        LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LOW= 99990
90        TRANSFORMER TURNS RATIO 073:1
54        TURN ON VALVE #1
05        INITIAL SQUEEZE 25 CYCLES
62        REPEAT (AT NEXT FUNCTION)
54        TURN ON VALVE #1
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
30        WELD 10 CY. 00050 AMPS
78        PROCESS WELD FAULTS
03        HOLD 05 CYCLES
55        TURN OFF VALVE #1
53        TURN OFF ISOLATION CONTACTOR
04        OFF 20 CYCLES
```
END OF SCHEDULE

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Default Weld Schedules in Program #T02301

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Following are the default schedules for program #T02301. Separate schedules apply to operation for a robot, welding machine and manual or portable welding gun. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Schedule: Robot

```
START OF SCHEDULE
82        LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LOW=99990
90        TRANSFORMER TURNS RATIO: 073:1
54        TURN ON VALVE #1
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
80        TURN ON CONTACTOR SELECT #01
30        WELD 10 CY. 00050 AMPS
81        TURN OFF CONTACTOR SELECT #01
03        HOLD 05 CYCLES
85        WAIT FOR NO INITIATE IF FAULT
55        TURN OFF VALVE #1
53        TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Machine

```
START OF SCHEDULE
82        LINEAR STEPPER #00 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LO=99990
90        TRANSFORMER TURNS RATIO: 073:1
58        TURN ON WELD IN PROGRESS
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
80        TURN ON CONTACTOR SELECT #01
30        WELD 10 CY. 00050 AMPS
81        TURN OFF CONTACTOR SELECT #01
03        HOLD 05 CYCLES
80        TURN ON CONTACTOR SELECT #02
30        WELD 10 CY. 00050 AMPS
81        TURN OFF CONTACTOR SELECT #02
03        HOLD 05 CYCLES
80        TURN ON CONTACTOR SELECT #03
30        WELD 10 CY. 00050 AMPS
81        TURN OFF CONTACTOR SELECT #03
03        HOLD 05 CYCLES
80        TURN ON CONTACTOR SELECT #04
30        WELD 10 CY. 00050 AMPS
81        TURN OFF CONTACTOR SELECT #04
03        HOLD 05 CYCLES
50        TURN ON WELD COMPLETE
64        TURN OFF WELD IN PROGRESS
75        EXTEND UNTIL NO INITIATE
51        TURN OFF WELD COMPLETE
53        TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Gun

```
START OF SCHEDULE
82        LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LOW= 99990
90        TRANSFORMER TURNS RATIO 073:1
54        TURN ON VALVE #1
05        INITIAL SQUEEZE 25 CYCLES
62        REPEAT (AT NEXT FUNCTION)
54        TURN ON VALVE #1
52        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
30        WELD 10 CY. 00050 AMPS
78        PROCESS WELD FAULTS
03        HOLD 05 CYCLES
55        TURN OFF VALVE #1
53        TURN OFF ISOLATION CONTACTOR
04        OFF 20 CYCLES
END OF SCHEDULE
```

Default Weld Schedules in Program #T02302

· · · · · · · · · · · ·

Following are the default schedules for program #T02302. Separate schedules apply to operation for a robot, welding machine and manual or portable welding gun. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Schedule: Robot

```
START OF SCHEDULE
82          LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76          SEC. CURR LIMITS: HI=00000 LOW=99990
90          TRANSFORMER TURNS RATIO: 073:1
54          TURN ON VALVE #1
52          TURN ON ISOLATION CONTACTOR
01          SQUEEZE 30 CYCLES
80          TURN ON CONTACTOR SELECT #01
30          WELD 10 CY. 00050 AMPS
81          TURN OFF CONTACTOR SELECT #01
03          HOLD 05 CYCLES
85          WAIT FOR NO INITIATE IF FAULT
55          TURN OFF VALVE #1
53          TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Machine

```
START OF SCHEDULE
82          LINEAR STEPPER #00 ASSIGNED (0 = OFF)
76          SEC. CURR LIMITS: HI=00000 LO=99990
90          TRANSFORMER TURNS RATIO: 073:1
58          TURN ON WELD IN PROGRESS
52          TURN ON ISOLATION CONTACTOR
01          SQUEEZE 30 CYCLES
10          TURN ON CONTACTOR SELECT #01
30          WELD 10 CY. 00050 AMPS
11          TURN OFF CONTACTOR SELECT #01
03          HOLD 05 CYCLES
10          TURN ON CONTACTOR SELECT #02
30          WELD 10 CY. 00050 AMPS
11          TURN OFF CONTACTOR SELECT #02
03          HOLD 05 CYCLES
10          TURN ON CONTACTOR SELECT #03
30          WELD 10 CY. 00050 AMPS
11          TURN OFF CONTACTOR SELECT #03
03          HOLD 05 CYCLES
10          TURN ON CONTACTOR SELECT #04
30          WELD 10 CY. 00050 AMPS
11          TURN OFF CONTACTOR SELECT #04
03          HOLD 05 CYCLES
50          TURN ON WELD COMPLETE
64          TURN OFF WELD IN PROGRESS
75          EXTEND UNTIL NO INITIATE
51          TURN OFF WELD COMPLETE
53          TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Gun

```
START OF SCHEDULE
82          LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76          SEC. CURR LIMITS: HI=00000 LOW= 99990
90          TRANSFORMER TURNS RATIO 073:1
54          TURN ON VALVE #1
05          INITIAL SQUEEZE 25 CYCLES
62          REPEAT (AT NEXT FUNCTION)
54          TURN ON VALVE #1
52          TURN ON ISOLATION CONTACTOR
01          SQUEEZE 30 CYCLES
30          WELD 10 CY. 00050 AMPS
78          PROCESS WELD FAULTS
03          HOLD 05 CYCLES
55          TURN OFF VALVE #1
53          TURN OFF ISOLATION CONTACTOR
04          OFF 20 CYCLES
END OF SCHEDULE
```

Default Weld Schedules in Program #T02304

. . . .

Following are the default schedules for program #T02304. Separate schedules apply to operation for a robot, welding machine and manual or portable welding gun. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Schedule: Robot

```
START OF SCHEDULE
82        LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76        SEC. CURR LIMITS: HI=00000 LOW=99990
81        TRANSFORMER TURNS RATIO: 073:1
50        TURN ON VALVE #1
88        TURN ON ISOLATION CONTACTOR
01        SQUEEZE 30 CYCLES
30        WELD 10 CY. 00050 AMPS
03        HOLD 05 CYCLES
51        TURN OFF WELD VALVE #1
89        TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Gun

```
START OF SCHEDULE
82 LINEAR STEPPER #01 ASSIGNED (0 = OFF)
76SEC. CURR LIMITS: HI=00000 LOW= 99990
81 TRANSFORMER TURNS RATIO 073:1
50 TURN ON VALVE #1
05 INITIAL SQUEEZE 25 CYCLES
62 REPEAT (AT NEXT FUNCTION)
50 TURN ON VALVE #1
88TURN ON ISOLATION CONTACTOR
01SQUEEZE 30 CYCLES
30WELD 10 CY. 00050 AMPS
85 PROCESS WELD FAULTS
03HOLD 05 CYCLES
51 TURN OFF VALVE #1
89TURN OFF ISOLATION CONTACTOR
04 OFF 20 CYCLES
END OF SCHEDULE
```

Default Weld Schedules in Program #T02306

. . . .

Following are the default schedules for program #T02306. Separate schedules apply to operation for a welding machine and seam welding. Schedules 1 - 15 are defined for each default sequence. Schedules 16 - 99 are defined as blank.

Default Weld Schedule: Machine

```
START OF SCHEDULE
19       SEC. CURRENT LIMITS: HI=00000 LO= 99990
44       SET FORGE/PRECOMPRESSION FORCE 1200 LBS
43       SET WELD FORCE 0900 LBS
15       TRANSFORMER TURNS RATIO 73:1
48       ADDITIONAL CURRENT (+) 00%  (-) 00%
73       TURN ON LOW PRESSURE WELD VALVE
85       TURN ON ISOLATION CONTACTOR
05       INITIAL SQUEEZE 60 CYCLES
61       WAIT FOR STAGE 2 INITIATE
01       SQUEEZE 05 CYCLES
22       PREHEAT 00 CY, 20% I
02       COOL 00 CYCLES
20       WELD 08 CY. 50% I
03       HOLD 10 CYCLES
74       TURN OFF LOW PRESSURE WELD VALVE
83       TURN ON SEAM DRIVE/EOH
07       WAIT 5 CYCLES
84       TURN OFF SEAM DRIVE/EOH
86       TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Default Weld Schedule: Seam

```
START OF SCHEDULE
19       SEC. CURRENT LIMITS: HI=00000 LO= 99990
44       SET FORGE/PRECOMPRESSION FORCE 1200 LBS
43       SET WELD FORCE 0900 LBS
15       TRANSFORMER TURNS RATIO 73:1
48       ADDITIONAL CURRENT (+) 00%  (-) 00%
73       TURN ON LOW PRESSURE WELD VALVE
85       TURN ON ISOLATION CONTACTOR
05       INITIAL SQUEEZE 60 CYCLES
61       WAIT FOR STAGE 2 INITIATE
01       SQUEEZE 05 CYCLES
83       TURN ON SEAM DRIVE/EOH
60       IMPULSE 3 HT CYC 1 COOL CYC
20       WELD 01 IMP. 50% I
69       EXTEND UNTIL NO INITIATE
03       HOLD 10 CYCLES
74       TURN OFF LOW PRESSURE WELD VALVE
07       WAIT 5 CYCLES
84       TURN OFF SEAM DRIVE/EOH
86       TURN OFF ISOLATION CONTACTOR
END OF SCHEDULE
```

Function List T03300 (Standard AC)

. . . .

FUN01	SQUEEZE NN CYCLES	
FUN02	COOL NN CYCLES	
FUN03	HOLD NN CYCLES	
FUN04	OFF NN CYCLES	
FUN05	INITIAL SQUEEZE NN CYCLES	
FUN06	*	
FUN07	WAIT NN CYCLES	
FUN08	*	
FUN09	STEPPER MACH=NN PART=NN (0=OFF)	
FUN10	RESET STEPPER NN	
FUN11	*	
FUN12	*	
FUN13	*	
FUN14	*	
FUN15	*	
FUN16	*	
FUN17	*	
FUN18	*	
FUN19	*	
FUN20	WELD NN CYC/IMP AT NN %I	
FUN21	TEMPER NN CYC/IMP AT NN %I	
FUN22	PREHEAT NN CYC/IMP AT NN %I	
FUN23	POSTHEAT NN CYC/IMP AT NN %I	
FUN24	PRE-WELD NN CYC/IMP AT NN %I	
FUN25	WELD NN CYCLES AT NN.N%I	
FUN26	WELD NN HALF-CYCLES AT NN.N%I	
FUN27	*	
FUN28	*	
FUN29	*	
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS	
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS	
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS	
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS	
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS	
FUN35	*	
FUN36	WELD NN HALF CYCLES NNNN0 AMPS	
FUN37	*	
FUN38	WELD NNN IMP NNNN0 AMPS HIGH NNNN0 AMPS LOW	
FUN39	TEST FIRE NN %I	
FUN40	SLOPE NN %I TO NN %I	
FUN41	SET VALVE N TOUCH DOWN PRESSURE NN PSI	
FUN42	SET VALVE N TIP DRESS PRESSURE NN PSI	
FUN43	SET VALVE N CYLINDER PRESSURE TO NN PSI	
FUN44	*	
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS	
FUN46	*	
FUN47	WAIT NN CYCLES FOR PRESSURE ACHIEVED*	
FUN48	TURN ON CONTACTOR SELECT #N	
FUN49	TURN OFF CONTACTOR SELECT #N	
FUN50	TURN ON WELD COMPLETE	
FUN51	TURN OFF WELD COMPLETE	
FUN52	TURN ON ISOLATION CONTACTOR	
FUN53	TURN OFF ISOLATION CONTACTOR	
FUN54	TURN ON VALVE #N	
FUN55	TURN OFF VALVE #N	
FUN56	TURN ON PRESSURE SELECT #N	

FUN57	TURN OFF PRESSURE SELECT #N
FUN58	TURN ON OUTPUT #N
FUN59	TURN OFF OUTPUT #N
FUN60	IMPULSE= NN HEAT CY NN COOL CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON WELD IN PROGRESS
FUN64	TURN OFF WELD IN PROGRESS
FUN65	*
FUN66	WAIT NNN CY FOR INP #N TO BE N (0=OFF,1=ON)
FUN67	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	WAIT NNN CY FOR LINE > NNN VOLTS
FUN73	WAIT FOR LINE > NNN VOLTS
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY = NN SEC.
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CY FOR SYSTEM COOLING
FUN80	VERIFY TIPS DOWN EVERY NN CY NN TIMES
FUN81	SLOW CYLINDER TEST EVERY NN CY NN TIMES
FUN82	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN83	SUREWELD STEPPER #NN ASSIGNED (0 = OFF)
FUN84	WINDOW: HI= +NN% LO= -NN% C-FACTOR=NNN
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN - STEP NN, N STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	FAULT IF TIPS TOUCHING
FUN92	FAULT IF TIPS NOT TOUCHING
FUN93	INITIAL PF LIMIT: HI= NN% LOW= NN%
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN0
FUN96	POWER FACTOR LIMIT: HI= NN% LOW= NN%*
FUN97	C-FACTOR LIMIT: HI= NNN LO= NNN
FUN98	GOTO SEQ #NN IF CURRENT LESS THAN NNNN0
FUN99	GOTO SEQ #NN
FUN100	*

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M-032116 Programs #T03300, #T02300 and #T02400

Function List T03302 (AC w/Ohma Cylinder Support)

· · · · · · · · · · · ·

FUN01	SQUEEZE NN CYCLES	
FUN02	COOL NN CYCLES	
FUN03	HOLD NN CYCLES	
FUN04	OFF NN CYCLES	
FUN05	INITIAL SQUEEZE NN CYCLES	
FUN06	*	
FUN07	WAIT NN CYCLES	
FUN08	*	
FUN09	STEPPER MACH=NN PART=NN (0=OFF)	
FUN10	RESET STEPPER NN	
FUN11	*	
FUN12	*	
FUN13	*	
FUN14	*	
FUN15	TURN ON ADVANCE VALVE #N SQZ NN CY	
FUN16	TURN ON INTENSIFY VALVE SQZ NN CY	
FUN17	TURN OFF INTENSIFY/ADV VALVE #N	
FUN18	TURN OFF INT/ADV VALVE #N OPEN NNN CY/2	
FUN19	*	
FUN20	WELD NN CYC/IMP AT NN %I	
FUN21	TEMPER NN CYC/IMP AT NN %I	
FUN22	PREHEAT NN CYC/IMP AT NN %I	
FUN23	POSTHEAT NN CYC/IMP AT NN %I	
FUN24	PRE-WELD NN CYC/IMP AT NN %I	
FUN25	WELD NN CYCLES AT NN.N%I	
FUN26	WELD NN HALF-CYCLES AT NN.N%I	
FUN27	*	
FUN28	*	
FUN29	*	
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS	
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS	
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS	
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS	
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS	
FUN35	*	
FUN36	WELD NN HALF CYCLES NNNN0 AMPS	
FUN37	*	
FUN38	WELD NNN IMP NNNN0 AMPS HIGH NNNN0 AMPS LOW	
FUN39	TEST FIRE NN %I	
FUN40	SLOPE NN %I TO NN %I	
FUN41	SET VALVE N TOUCH DOWN PRESSURE NN PSI	
FUN42	SET VALVE N TIP DRESS PRESSURE NN PSI	
FUN43	SET VALVE N CYLINDER PRESSURE TO NN PSI	
FUN44	*	
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS	
FUN46	*	
FUN47	WAIT ,2, CYCLES FOR PRESSURE ACHIEVED*	
FUN48	TURN ON CONTACTOR SELECT #,2,$,1,MAXSCRS	
FUN49	TURN OFF CONTACTOR SELECT #,2,$,1,MAXSCRS	
FUN50	TURN ON WELD COMPLETE*	
FUN51	TURN OFF WELD COMPLETE*	
FUN52	TURN ON ISOLATION CONTACTOR*	
FUN53	TURN OFF ISOLATION CONTACTOR*	
FUN54	TURN ON VALVE #,1,$,0,MAXOUTS	
FUN55	TURN OFF VALVE #,1,$,0,MAXOUTS	
FUN56	TURN ON PRESSURE SELECT #,1,$,0,PSELOUTM	

FUN57	TURN OFF PRESSURE SELECT #N
FUN58	TURN ON OUTPUT #N
FUN59	TURN OFF OUTPUT #N
FUN60	IMPULSE= NN HEAT CY NN COOL CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON WELD IN PROGRESS
FUN64	TURN OFF WELD IN PROGRESS
FUN65	*
FUN66	WAIT NNN CY FOR INP #N TO BE N (0=OFF,1=ON)
FUN67	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	WAIT NNN CY FOR LINE > NNN VOLTS
FUN73	WAIT FOR LINE > NNN VOLTS
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY = NN SEC.
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CY FOR SYSTEM COOLING
FUN80	VERIFY TIPS DOWN EVERY NN CY NN TIMES
FUN81	SLOW CYLINDER TEST EVERY NN CY NN TIMES
FUN82	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN83	SUREWELD STEPPER #NN ASSIGNED (0 = OFF)
FUN84	WINDOW: HI= +NN% LO= -NN% C-FACTOR=NNN
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN - STEP NN, N STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	FAULT IF TIPS TOUCHING
FUN92	FAULT IF TIPS NOT TOUCHING
FUN93	INITIAL PF LIMIT: HI= NN% LOW= NN%
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN0
FUN96	POWER FACTOR LIMIT: HI= NN% LOW= NN%*
FUN97	C-FACTOR LIMIT: HI= NNN LO= NNN
FUN98	GOTO SEQ #NN IF CURRENT LESS THAN NNNN0
FUN99	GOTO SEQ #NN
FUN100	*

Function List T03310 (AC - GM WS2 Specification)

. . . .

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	*
FUN07	WAIT NN CYCLES
FUN08	*
FUN09	*
FUN10	*
FUN11	*
FUN12	*
FUN13	*
FUN14	*
FUN15	*
FUN16	*
FUN17	*
FUN18	*
FUN19	*
FUN20	WELD NN CYC/IMP AT NN %I
FUN21	TEMPER NN CYC/IMP AT NN %I
FUN22	PREHEAT NN CYC/IMP AT NN %I
FUN23	POSTHEAT NN CYC/IMP AT NN %I
FUN24	PRE-WELD NN CYC/IMP AT NN %I
FUN25	WELD NN CYCLES AT NN.N%I
FUN26	WELD NN HALF-CYCLES AT NN.N%I
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS
FUN35	*
FUN36	WELD NN HALF CYCLES NNNN0 AMPS
FUN37	*
FUN38	*
FUN39	TEST FIRE NN %I
FUN40	SLOPE NN %I TO NN %I
FUN41	*
FUN42	*
FUN43	*
FUN44	*
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS
FUN46	*
FUN47	*
FUN48	*
FUN49	*
FUN50	TURN ON WELD COMPLETE
FUN51	TURN OFF WELD COMPLETE
FUN52	TURN ON ISOLATION CONTACTOR
FUN53	TURN OFF ISOLATION CONTACTOR
FUN54	TURN ON VALVE #N
FUN55	TURN OFF VALVE #N
FUN56	SET PRESSURE = N

FUN57	*
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE= NN HEAT CY NN COOL CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON OUTPUT #N
FUN64	TURN OFF OUTPUT #N
FUN65	WAIT NNN CY FOR INP #N TO BE N (0=OFF,1=ON)
FUN66	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN67	*
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	WAIT NNN CY FOR LINE > NNN VOLTS
FUN73	WAIT FOR LINE > NNN VOLTS
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY = NN SEC.
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CY FOR SYSTEM COOLING
FUN80	VERIFY TIPS DOWN EVERY NN CY NN TIMES
FUN81	SLOW CYLINDER TEST EVERY NN CY NN TIMES
FUN82	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN83	*
FUN84	WINDOW: HI= +NN% LO= -NN% C-FACTOR=NNN
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN - STEP NN, N STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	FAULT IF TIPS TOUCHING
FUN92	FAULT IF TIPS NOT TOUCHING
FUN93	INITIAL PF LIMIT: HI= NN% LOW= NN%
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN0
FUN96	POWER FACTOR LIMIT: HI= NN% LOW= NN%*
FUN97	C-FACTOR LIMIT: HI= NNN LO= NNN
FUN98	GOTO SEQ #NN IF CURRENT LESS THAN NNNN0
FUN99	GOTO SEQ #NN
FUN100	*

Function List T03311 (AC - GM WS2 / ABB Robot)

. . . .

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	*
FUN07	WAIT NN CYCLES
FUN08	*
FUN09	*
FUN10	*
FUN11	*
FUN12	*
FUN13	*
FUN14	*
FUN15	*
FUN16	*
FUN17	*
FUN18	*
FUN19	*
FUN20	WELD NN CYC/IMP AT NN %I
FUN21	TEMPER NN CYC/IMP AT NN %I
FUN22	PREHEAT NN CYC/IMP AT NN %I
FUN23	POSTHEAT NN CYC/IMP AT NN %I
FUN24	PRE-WELD NN CYC/IMP AT NN %I
FUN25	WELD NN CYCLES AT NN.N%I
FUN26	WELD NN HALF-CYCLES AT NN.N%I
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS
FUN35	*
FUN36	WELD NN HALF CYCLES NNNN0 AMPS
FUN37	*
FUN38	*
FUN39	TEST FIRE NN %I
FUN40	SLOPE NN %I TO NN %I
FUN41	*
FUN42	*
FUN43	*
FUN44	*
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS
FUN46	*
FUN47	*
FUN48	*
FUN49	*
FUN50	TURN ON WELD COMPLETE
FUN51	TURN OFF WELD COMPLETE
FUN52	TURN ON ISOLATION CONTACTOR
FUN53	TURN OFF ISOLATION CONTACTOR
FUN54	TURN ON VALVE #N
FUN55	TURN OFF VALVE #N
FUN56	SET PRESSURE = N

FUN57	*
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE= NN HEAT CY NN COOL CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON OUTPUT #N
FUN64	TURN OFF OUTPUT #N
FUN65	WAIT NNN CY FOR INP #N TO BE N (0=OFF,1=ON)
FUN66	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN67	*
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	WAIT NNN CY FOR LINE > NNN VOLTS
FUN73	WAIT FOR LINE > NNN VOLTS
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY = NN SEC.
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CY FOR SYSTEM COOLING
FUN80	VERIFY TIPS DOWN EVERY NN CY NN TIMES
FUN81	SLOW CYLINDER TEST EVERY NN CY NN TIMES
FUN82	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN83	SUREWELD STEPPER #NN ASSIGNED (0 = OFF)
FUN84	WINDOW: HI= +NN% LO= -NN% C-FACTOR=NNN
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN - STEP NN, N STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	FAULT IF TIPS TOUCHING
FUN92	FAULT IF TIPS NOT TOUCHING
FUN93	INITIAL PF LIMIT: HI= NN% LOW= NN%
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN0
FUN96	POWER FACTOR LIMIT: HI= NN% LOW= NN%
FUN97	C-FACTOR LIMIT: HI= NNN LO= NNN
FUN98	GOTO SEQ #NN IF CURRENT LESS THAN NNNN0
FUN99	GOTO SEQ #NN
FUN100	*

Function List T02300 (Standard MFDC Software)
. . . .

This is the list of funcations for the T02300 MFDC MedWeld 4000 software.

NOTE: *A * in the function list will indicate there is currently no function in that position. Functions that contain a * may be reserved for future use.*

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	*
FUN07	WAIT NN CYCLES
FUN08	POS ANALOG WINDOW=.NNNN +/- .NNNN E+N
FUN09	NEG ANALOG WINDOW=.NNNN +/- .NNNN E+N
FUN10	TURN ON CONTACTOR SELECT #N
FUN11	TURN OFF CONTACTOR SELECT #N
FUN12	ABORT IF ANALOG INPUT #N NOT IN WINDOW
FUN13	FAULT IF ANALOG INPUT #N NOT IN WINDOW
FUN14	EXTEND UNTIL #N IN WINDOW OR NN TIMES
FUN15	READ ANALOG #N CALIBRATION ZERO POINT
FUN16	WAIT FOR ANALOG #N
FUN17	WAIT FOR ANALOG #N IN WINDOW OR NN CY
FUN18	SET ANALOG OUTPUT #N TO .NNNN E+N
FUN19	READ ANALOG #N RELATIVE ZERO POINT$
FUN20	WELD NN CYC/IMP AT NN %I
FUN21	TEMPER NN CYC/IMP AT NN %I
FUN22	PREHEAT NN CYC/IMP AT NN %I
FUN23	POSTHEAT NN CYC/IMP AT NN %I
FUN24	PRE-WELD NN CYC/IMP AT NN %I
FUN25	WELD NN CYCLES AT NN.N%I
FUN26	WELD NN HALF-CYCLES AT NN.N%I
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS
FUN35	*
FUN36	WELD NN HALF CYCLES AMPS
FUN37	*
FUN38	*
FUN39	*
FUN40	SLOPE NN %I TO NN %I
FUN41	SLOPE NN HALF CYCLES %I
FUN42	*
FUN43	*
FUN44	*
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS
FUN46	SLOPE NN HALF CYCLES NNNN0 AMPS TO NNNN0 AMPS

FUN47	*
FUN48	*
FUN49	WELD NNN IMP. NNNN0 AMP HI NNNN0 AMP
FUN50	TURN ON WELD COMPLETE
FUN51	TURN OFF WELD COMPLETE
FUN52	TURN ON ISOLATION CONTACTOR
FUN53	TURN OFF ISOLATION CONTACTOR
FUN54	TURN ON VALVE #N
FUN55	TURN OFF VALVE #N
FUN56	TURN ON PRESSURE SELECT
FUN57	TURN OFF PRESSURE SELECT
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE NN HEAT HALF CY NN COOL HALF
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON OUTPUT #N
FUN64	TURN OFF OUTPUT #N
FUN65	WAIT NNN CY INP #N TO BE (0=OFF,1=ON)
FUN66	WAIT FOR INPUT #N TO BE (0=OFF,1=ON)
FUN67	EXTEND WHILE INPUT #N IS (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	OUTPUT #1 ON DELAY
FUN73	OUTPUT #1 OFF DELAY
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY = NN SECONDS
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CYCLES FOR SYSTEM COOLING
FUN80	*
FUN81	*
FUN82	LINEAR STEPPER #N ASSIGNED (0 = OFF)
FUN83	*
FUN84	WINDOW: HI=+NN'% LO=-NN'%
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #1 IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	*
FUN92	*
FUN93	*
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN AMPS
FUN96	*
FUN97	C-FACTOR LIMIT: HI=NNNN LO=NNNN
FUN98	*
FUN99	GOTO SEQ#NN
FUN100	*'

Function List T02301 (Medar MFDC Inverter Type 1)

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NOTE: *A * in the function list will indicate there is currently no function in that position. Functions that contain a * may be reserved for future use.*

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES*'
FUN03	HOLD NN CYCLES*'
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	*
FUN07	WAIT NN CYCLES
FUN08	EXTEND NN TIMES UNTIL PRESSURE >=NNN
FUN09	EXTEND NN TIMES UNTIL PRESS >=NNN
FUN10	WAIT FOR PRESS <=NNN
FUN11	WAIT FOR PRESS >=NNN
FUN12	EXTEND NN TIMES UNTIL FORCE <=NNN
FUN13	EXTEND NN TIMES UNTIL FORCE >=NNN
FUN14	WAIT FOR FORCE <=NNN
FUN15	WAIT FOR FORCE >=NNN
FUN16	EXTEND NN TIMES UNTIL DISPL <=NNN
FUN17	EXTEND NN TIMES UNTIL DISPL >=NNN
FUN18	WAIT FOR DISPL <= NNN
FUN19	WAIT FOR DISPL >= NNN
FUN20	WELD NN CYC/IMP AT NN %I
FUN21	TEMPER NN CYC/IMP AT NN %I
FUN22	PREHEAT NN CYC/IMP AT NN %I
FUN23	POSTHEAT NN CYC/IMP AT NN %I
FUN24	PRE-WELD NN CYC/IMP AT NN %I
FUN25	WELD NN CYC/IMP AT NN.N %I
FUN26	WELD NN HALF-CYCLES AT NN.N %I
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NNNN0 CYC/IMP AT NNNN0 AMPS
FUN31	TEMPER NNNN0 CYC/IMP AT NNNN0 AMPS
FUN32	PREHEAT NNNN0 CYC/IMP AT NNNN0 AMPS
FUN33	POSTHEAT NNNN0 CYC/IMP AT NNNN0 AMPS
FUN34	PRE-WELD NNNN0 CYC/IMP AT NNNN0 AMPS
FUN35	*
FUN36	WELD NN HALF-CYCLES AT NNNN0 AMPS
FUN37	*
FUN38	*
FUN39	*
FUN40	SLOPE NN %I TO NN %I
FUN41	SLOPE NN HALF-CYCLES NN %I TO NN %I
FUN42	*
FUN43	*
FUN44	*
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS
FUN46	SLOPE NN HALF CYCLES NNNN0 AMPS TO NNNN0 AMPS
FUN47	*
FUN48	*
FUN49	WELD NNN IMP. NNNN AMP HI, NNNN AMP LO

FUN50	TURN ON WELD COMPLETE
FUN51	TURN OFF WELD COMPLETE
FUN52	TURN ON ISOLATION CONTACTOR
FUN53	TURN OFF ISOLATION CONTACTOR
FUN54	TURN ON VALVE #N
FUN55	TURN OFF VALVE #N
FUN56	TURN ON PRESSURE SELECT #N
FUN57	TURN OFF PRESSURE SELECT #N
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE NN HEAT HALF CY NN COOL HALF CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON OUTPUT #N
FUN64	TURN OFF OUTPUT #N
FUN65	WAIT NNN CY FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN66	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN67	EXTEND WHILE INPUT #N IS N (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	OUTPUT #N ON DELAY NNNN HALF CYCLES
FUN73	OUTPUT #N OFF DELAY NNNN HALF CYCLES
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY =NN SEC
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CYCLES FOR SYSTEM COOLING
FUN80	TURN ON CONTACTOR SELECT #N
FUN81	TURN OFF CONTACTOR SELECT #N
FUN82	LINEAR STEPPER #N ASSIGNED (0 = OFF)
FUN83	STEPPER MACH=NN PART=NN (0=OFF)
FUN84	WINDOW: HI=+NN% LO=-NN%
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	SET VALVE N TO NNN PSI
FUN92	SET VALVE N TO NNN PSI AFTER NN CY
FUN93	WAIT NN CY PRESSURE ACHIEVED
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN
FUN96	*
FUN97	C-FACTOR LIMIT: HI=NNNN LO=NNNN
FUN98	RESET STEPPER NN
FUN99	GOTO SEQ#NN
FUN100	*

Function List T02302 (MFDC w/Pressure Control and Ohma Cylinder)

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NOTE:　　　*A * in the function list will indicate there is currently no function in that position. Functions that contain a * may be reserved for future use.*

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	*
FUN07	WAIT NN CYCLES
FUN08	*
FUN09	*
FUN10	TURN ON CONTACTOR SELECT #N
FUN11	TURN OFF CONTACTOR SELECT #N
FUN12	SET VALVE #N TOUCH DOWN PRESSURE NN PSI
FUN13	SET VALVE #N TIP DRESS PRESSURE NN PSI
FUN14	SET VALVE #N CYLINDER PRESSURE TO NN PSI
FUN15	WAIT NN CYCLES FOR PRESSURE ACHIEVED
FUN16	TURN ON ADVANCE VALVE #NN SQZ NN CYC
FUN17	TURN ON INTENSIFY VALVE SQZ NN CY
FUN18	TURN OFF INTENSIFY/ADV VALVE #N
FUN19	TURN OFF INT/ADV VALVE #N OPEN NNN HALF-CYCLES
FUN20	WELD NN CYC/IMP NN %I
FUN21	TEMPER NN CYC/IMP NN %I
FUN22	PREHEAT NN CYC/IMP NN %I
FUN23	POSTHEAT NN CYC/IMP NN %I
FUN24	PRE-WELD NN CYC/IMP NN %I
FUN25	WELD NN CYC/IMP NN.N %I
FUN26	WELD NN HALF CYCLES NN.N %I
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP NNNN0 AMPS
FUN31	TEMPER NN CYC/IMP NNNN0 AMPS
FUN32	PREHEAT NN CYC/IMP NNNN0 AMPS
FUN33	POSTHEAT NN CYC/IMP NNNN0 AMPS
FUN34	PRE-WELD NNNN0 AMPS
FUN35	*
FUN36	WELD NN HALF CYCLES NNNN0 AMPS
FUN37	*
FUN38	*
FUN39	*
FUN40	SLOPE NN %I TO NN %I
FUN41	SLOPE NN HALF CYCLES NN %I TO NN %I
FUN42	*
FUN43	*
FUN44	*
FUN45	SLOPE NNNN0 AMPS TO NNNN0 AMPS
FUN46	SLOPE NN HALF CYCLES NNNN0 A. TO NNNN0 A.
FUN47	*
FUN48	*
FUN49	WELD NNN IMP. NNNN AMP HI, NNNN AMP LO
FUN50	TURN ON WELD COMPLETE
FUN51	TURN OFF WELD COMPLETE
FUN52	TURN ON ISOLATION CONTACTOR
FUN53	TURN OFF ISOLATION CONTACTOR
FUN54	TURN ON VALVE #N

FUN55	TURN OFF VALVE #N
FUN56	TURN ON PRESSURE SELECT #N
FUN57	TURN OFF PRESSURE SELECT #N
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE NN HEAT HALF CY NN COOL HALF CY
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON OUTPUT #N
FUN64	TURN OFF OUTPUT #N
FUN65	WAIT ',3,' CY INP #N TO BE N (0=OFF,1=ON)
FUN66	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN67	EXTEND WHILE INPUT #N IS N (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	WAIT NNN CY FOR WELD PROCEED INPUT
FUN71	WAIT FOR WELD PROCEED INPUT
FUN72	OUTPUT #N ON DELAY NNNN HALF CYCLES
FUN73	OUTPUT #N OFF DELAY NNNN HALF CYCLES
FUN74	WELD NNN IMP. NN %I HIGH NN %I LOW
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	ISOLATION CONTACTOR DELAY =NN SEC
FUN78	PROCESS WELD FAULTS
FUN79	WAIT NNN CYCLES FOR SYSTEM COOLING
FUN80	*
FUN81	*
FUN82	LINEAR STEPPER #N ASSIGNED (0 = OFF)
FUN83	
FUN84	WINDOW: HI=+NN% LO=-NN%
FUN85	WAIT FOR NO INITIATE IF FAULT
FUN86	TIP DRESS ADVANCE: GROUP NN STEPS
FUN87	SET SPC OFFSET TO NN
FUN88	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN89	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN90	TRANSFORMER TURNS RATIO NNN:1
FUN91	*
FUN92	*
FUN93	*
FUN94	EXTEND WELD IF LOW CURRENT LIMIT FAULT
FUN95	EXTEND WELD IF CURRENT LESS THAN NNNN
FUN96	*
FUN97	C-FACTOR LIMIT: HI=NNNN LO=NNNN
FUN98	*
FUN99	GOTO SEQ#NN
FUN100	*

Function List T02304 (MFDC for Multi-inverter Systems)

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NOTE: *A * in the function list will indicate there is currently no function in that position. Functions that contain a * may be reserved for future use.*

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	QUENCH NN CYCLES
FUN07	WAIT NN CYCLES
FUN08	PRE-COMPRESSION NN CYCLES
FUN09	GUN WAIT DELAY NN CYCLES
FUN10	DELAY NN CYCLES
FUN11	PLATEN DELAY NN CYCLES
FUN12	WELD DELAY NN CYCLES
FUN13	METAL FORM TIME NN CYCLES
FUN14	*
FUN15	*
FUN16	*
FUN17	*
FUN18	*
FUN19	*
FUN20	WELD NN CYC/IMP AT NN %I
FUN21	TEMPER NN CYC/IMP AT NN %I
FUN22	PREHEAT NN CYC/IMP AT NN %I
FUN23	POSTHEAT NN CYC/IMP AT NN %I
FUN24	PRE-WELD NN CYC/IMP AT NN %I
FUN25	WELD NN CYC/IMP AT NN.N %I
FUN26	*
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP AT NNNN0 AMPS
FUN31	TEMPER NN CYC/IMP AT NNNN0 AMPS
FUN32	PREHEAT NN CYC/IMP AT NNNN0 AMPS
FUN33	POSTHEAT NN CYC/IMP AT NNNN0 AMPS
FUN34	PRE-WELD NN CYC/IMP AT NNNN0 AMPS
FUN35	*
FUN36	*
FUN37	*
FUN38	*
FUN39	*
FUN40	UPSLOPE NN CYC/IMP FROM NN %I TO NN %I
FUN41	DOWNSLOPE NN CYC/IMP FROM NN %I TO NN %I
FUN42	PRESLOPE NN CYC/IMP FROM NN %I TO NN %I
FUN43	POSTSLOPE NN CYC/IMP FROM NN %I TO NN %I
FUN44	*
FUN45	SLOPE NN CYC/IMP FROM NNNN0 AMPS TO NNNN0 AMPS
FUN46	*
FUN47	*
FUN48	*
FUN49	*
FUN50	TURN ON VALVE #N
FUN51	TURN OFF VALVE #N
FUN52	TURN ON OUTPUT #N
FUN53	TURN OFF OUTPUT #N
FUN54	TURN ON PRESSURE SELECT #N

FUN55	TURN OFF PRESSURE SELECT #N
FUN56	*
FUN57	*
FUN58	TURN ON WELD IN PROGRESS
FUN59	TURN OFF WELD IN PROGRESS
FUN60	IMPULSE= NN HEAT CYCLES, NN COOL CYCLES
FUN61	ABORT IF NO INITIATE FOR NN CYCLES
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	TURN ON WELD COMPLETE
FUN64	TURN OFF WELD COMPLETE
FUN65	ISOLATION CONTACTOR DELAY = NN SECONDS
FUN66	WAIT NNN CY INPUT #N TO BE N (0=OFF,1=ON)
FUN67	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN68	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN69	WAIT FOR PRESSURE SWITCH INPUT
FUN70	*
FUN71	*
FUN72	*
FUN73	*
FUN74	*
FUN75	EXTEND UNTIL NO INITIATE
FUN76	SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0
FUN77	EXTEND WHILE INPUT #N IS N (0=OFF,1=ON)
FUN78	*
FUN79	*
FUN80	*
FUN81	TRANSFORMER TURNS RATIO NNN:1
FUN82	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN83	*
FUN84	*
FUN85	PROCESS WELD FAULTS
FUN86	*
FUN87	*
FUN88	TURN ON ISOLATION CONTACTOR
FUN89	TURN OFF ISOLATION CONTACTOR
FUN90	SET SPC OFFSET TO NN
FUN92	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN92	C-FACTOR LIMIT: HI=NNNN LO=NNNN
FUN93	*
FUN94	*
FUN95	*
FUN96	*
FUN97	*
FUN98	*
FUN99	GOTO SEQ #NN
FUN100	*

Function List T02306 (MFDC for Multi-inverter Systems with Forge Valve)

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NOTE: *A * in the function list will indicate there is currently no function in that position. Functions that contain a * may be reserved for future use.*

FUN01	SQUEEZE NN CYCLES
FUN02	COOL NN CYCLES
FUN03	HOLD NN CYCLES
FUN04	OFF NN CYCLES
FUN05	INITIAL SQUEEZE NN CYCLES
FUN06	QUENCH NN CYCLES
FUN07	WAIT NN CYCLES
FUN08	INTERMITTENT DRIVE DELAY NNN CYCLES
FUN09	CONTINUOUS DRIVE DELAY NNN CYCLES
FUN10	MOTOR SPEED DELAY NNN CYCLES
FUN11	DELAY BEFORE INDEX NNN CYCLES
FUN12	INDEX DELAY NNN CYCLES
FUN13	SET SPC OFFSET TO NN
FUN14	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET
FUN15	TRANSFORMER TURNS RATIO NNN:1
FUN16	*
FUN17	WINDOW: HI=+NN% LO=-NN% C-FACTOR=NNN
FUN18	SEC. CURR LIMITS: HI=NNNNN LOW=NNNNN
FUN19	C-FACTOR LIMIT: HI=NNNN LO=NNNN
FUN20	WELD NNN CYC/IMP AT NN.N %I
FUN21	TEMPER NNN CYC/IMP AT NN.N %I
FUN22	PREHEAT NNN CYC/IMP AT NN.N %I
FUN23	WELD FIRST SPOT AT NN.N %I
FUN24	WELD NNN IMPULSES AT NN %I HIGH, NN %I LOW
FUN25	*
FUN26	*
FUN27	*
FUN28	*
FUN29	*
FUN30	WELD NN CYC/IMP AT NNNNN AMPS
FUN31	TEMPER NN CYC/IMP AT NNNNN AMPS
FUN32	PREHEAT NN CYC/IMP AT NNNNN AMPS
FUN33	WELD FIRST SPOT AT NNNNN AMPS
FUN34	WELD NNN IMPULSES AT NNNNN AMPS
FUN35	*
FUN36	*
FUN37	*
FUN38	*
FUN39	*
FUN40	SLOPE NN CYC/IMP FROM NN %I TO NN %I
FUN41	*
FUN42	*
FUN43	SET WELD FORCE NNNN LBS.
FUN44	SET FORGE / PRECOMPRESSION FORCE NNNN LBS.
FUN45	SLOPE NN CYC/IMP FROM NNNNN AMPS TO NNNNN AMPS
FUN46	*
FUN47	TIP DRESS ADVANCE: GROUP #NN (1-99), STEP #N (1-5)
FUN48	ADDITIONAL CURRENT: +NN%, -NN%
FUN49	LINEAR STEPPER #NN ASSIGNED (0 = OFF)
FUN50	POS ANALOG WINDOW=.NNNN +/- .NNNN E+N
FUN51	NEG ANALOG WINDOW=.NNNN +/- .NNNN E+N
FUN52	ABORT IF ANALOG INPUT #N NOT IN WINDOW
FUN53	FAULT IF ANALOG INPUT #N NOT IN WINDOW

FUN54	WAIT FOR ANALOG #N IN WINDOW
FUN55	WAIT FOR ANALOG #N IN WINDOW OR NN CY
FUN56	EXTEND UNTIL #N IN WINDOW OR NN TIMES
FUN57	READ ANALOG #N CALIBRATION ZERO POINT
FUN58	READ ANALOG #N RELATIVE ZERO POINT
FUN59	SET VALVE #N CYLINDER PRESSURE TO NN PSI
FUN60	IMPULSE= NN HEAT CYCLES, NN COOL CYCLES
FUN61	WAIT FOR STAGE #2 INITIATE
FUN62	REPEAT (AT NEXT FUNCTION)
FUN63	GOTO REPEAT IF STAGE #2 INITIATE
FUN64	WAIT FOR REPEAT INPUT ACTIVE
FUN65	WAIT FOR SYSTEM COOLING
FUN66	WAIT FOR FORCE NNNN TO BE +/- NNNN LBS.
FUN67	WAIT NNN CY INPUT #N TO BE N (0=OFF,1=ON)
FUN68	WAIT FOR INPUT #N TO BE N (0=OFF,1=ON)
FUN69	EXTEND UNTIL NO INITIATE
FUN70	EXTEND WHILE INPUT #N IS N (0=OFF,1=ON)
FUN71	TURN ON WELD VALVE HIGH PRESSURE
FUN72	TURN OFF WELD VALVE HIGH PRESSURE
FUN73	TURN ON WELD VALVE LOW PRESSURE
FUN74	TURN OFF WELD VALVE LOW PRESSURE
FUN75	TURN ON FORGE VALVE
FUN76	TURN OFF FORGE VALVE
FUN77	FORGE DELAY NNNN HALF-CYCLES
FUN78	FORGE NNN HALF-CYCLES
FUN79	TURN ON PRECOMPRESSION VALVE
FUN80	TURN OFF PRECOMPRESSION VALVE
FUN81	PRECOMPRESSION DELAY NNNN HALF-CYCLES
FUN82	PRECOMPRESSION NNN HALF-CYCLES
FUN83	TURN ON SEAM DRIVE / EOH
FUN84	TURN OFF SEAM DRIVE / EOH
FUN85	TURN ON ISOLATION CONTACTOR
FUN86	TURN OFF ISOLATION CONTACTOR
FUN87	ISOLATION CONTACTOR DELAY = NN SECONDS
FUN88	TURN ON VALVE #N
FUN89	TURN OFF VALVE #N
FUN90	*
FUN92	*
FUN92	*
FUN93	*
FUN94	*
FUN95	WAIT NNN CY FOR PRESSURE SWITCH INPUT
FUN96	VERIFY CYLINDER #N IS OUT OF RETRACT
FUN97	EXTEND IF LOW CURRENT LIMIT FAULT
FUN98	GOTO REPEAT NNN TIMES
FUN99	GOTO SEQ #NN
FUN100	*

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Setup Parameters 5

The MedWeld 4000 provides a number of programmable *setup parameters*. They allow for customizing the control to meet your application requirements.

These parameters "inform" the control about its operating environment. They also define the hardware (such as the type of transformer used and its turns ratio), and describe acceptable limits on the ranges of weld parameters (such as secondary current, power factor and C-factor).

Some parameters define the severity of fault conditions (as either FAULT or ALERT). They tell the control how to respond when it detects a fault condition:

- *FAULT* tells the control to turn OFF the NO FAULT output, or turn ON the FAULT output. This indicates that a fault condition was detected.

  Fault conditions normally inhibit initiation of a weld schedule. (Refer to the Initiation On Fault setup parameter on page 5-10.)

- *ALERT* tells the control to activate the ALERT output. An alert condition generally will not inhibit initiating a weld schedule.

- *NONE* tells the control to log that the condition was detected, but neither output is activated. This condition will not inhibit initiation of a weld schedule.

Parameter settings are programmable (with some exceptions). However, the *list* of parameters is fixed. You CANNOT remove a parameter from this list.

You can change the value assigned to a parameter from the DEP-100S Programming Device, *WSS* (Weld Support System) or *WebVIEW*. (Refer to "Programming the Weld Processor" on page 2-12 for further information on these programming options.)

NOTE: *To protect the operator or equipment, some parameters are NOT programmable. For these, you CANNOT change the setting or value.*

The following section shows each setup parameter as displayed at the programming device, along with all of the possible settings. For example, if a parameter is always defined as a fault condition, (FAULT) will appear. If it can be changed to an alert condition, you will see (FAULT) (ALERT).

If a parameter is a numeric value, this manual lists the default setting of that value. The acceptable range of values will also appear in parentheses.

Parameter Descriptions

. . . .

Most setup parameters are common to programs T03300 and T02300. The exceptions are noted acordingly.

INVALID SEQUENCE SELECTED: (FAULT)

This fault is generated if the PARITY input (when provided) was not used to provide the odd number of inputs needed to initiate a schedule. It can also indicate that the BINARY SELECT inputs have changed state while the processor is repeating.

WELD INITIATE NOT PRESENT: (FAULT) (ALERT)

If the weld schedule is using the function to TURN ON WELD COMPLETE, the MedWeld 4000 expects the INITIATE WELD input to remain active while executing the weld schedule. If this input is not active when the weld control executes the function TURN ON WELD COMPLETE, the control generates this condition.

If the weld schedule does not contain the TURN ON WELD COMPLETE function, the control does not generate this fault/alert condition.

CONTROL STOP: (FAULT) (ALERT)

This fault is generated if the CONTROL STOP input (normally high) goes low during the execution of a weld schedule, or if the CONTROL STOP input is not active when the control receives a weld initiate.

STEPPER APPROACHING MAX: (FAULT) (ALERT)
                             (NONE)

When a weld schedule is assigned to a linear stepper, this fault indicates that the stepper has begun the final step of the assigned stepper.

END OF STEPPER: (FAULT) (ALERT)

> The END OF STEPPER fault indicates that a stepper has completed the last weld in the final step of the assigned stepper.

HIGH CURRENT LIMIT: (FAULT) (ALERT)
LOW CURRENT LIMIT: (FAULT) (ALERT)

> These faults indicate that the welding conditions during a weld function, exceeded or fell below the range programmed in the setup parameters.

CONTROL FAILED TO FIRE
(**T02300 only**)   (FAULT) (ALERT)

> This condition occurs when the inverter assembly fails to fire the correct number of high-frequency half-cycles, as determined by the Inverter Operating High Frequency setup parameter and the number of weld AC cycles programmed in the schedule. (For example, the inverter may not fire the correct number of high-frequency cycles when it terminates the weld prematurely due to a HARD OVERCURRENT fault.)

SCR MISFIRE: (**T03300 only**)   (FAULT) (ALERT)

> This condition occurs if there is conduction on one half-cycle and no conduction on the next half-cycle during a weld function. This condition may result if arcing occurs during the weld functions.

TIPS NOT TOUCHING: (**T03300 only**) (FAULT)
TIPS TOUCHING: (**T03300 only**)   (FAULT)

> These two conditions are mutually exclusive. (Both cannot occur within one weld schedule.) Three causes can generate these faults:
>
> • If the schedule contains the test fire function (#39) and the function FAULT IF TIPS TOUCHING, AND the control detects *more than* 10 A. of primary current during the test fire, the control assumes that the tips were *closed*. It then generates the TIPS TOUCHING fault.
>
> • If the schedule contains the test fire function and the function FAULT IF TIPS NOT TOUCHING, AND the control detects *less than* 10 A. of primary current during the test fire, the control assumes that the tips were *open*. It generates the TIPS NOT TOUCHING fault.

- If the weld schedule contains the function VERIFY TIPS DOWN EVERY nn CYC nn TIMES, and the control performs the maximum number of test fires without reaching the desired current value (in the Tips Down Verified Current: nnnn setup parameter), it generates a TIPS NOT TOUCHING fault. (Refer to "Dynamic Squeeze Features" on page 7-6.)

SLOW CYLINDER FAULT: (**T03300 only**)(FAULT) (ALERT)

This fault is generated when the control executes the function SLOW CYLINDER TEST EVERY nn CYC. nn TIMES, and it detects that primary current has never reached the value programmed in the Tips Down Verified Current: setup parameter.

(The control repeats the test fire the number of tries programmed in this function.) Refer to "Dynamic Squeeze Features" on page 7-6.

INITIAL P.F. OUT OF RANGE: (**T03300**)(FAULT) (ALERT)

This fault is generated when the test fire function (#39) appears in a weld schedule before the function INITIAL PF LIMIT: HI=nn% LOW=nn%.

If the power factor (indicating secondary resistance) detected during the test fire is not within the range specified in this function, this condition is generated.

POWER FACTOR LIMIT: (**T03300 only**)(FAULT) (ALERT)

This condition is generated when the power factor detected while executing a weld schedule does not fall within the range defined by the High and Low Power Factor Limit setup parameters.

NOTE: *Function #96 permits overriding the setup parameter for power factor limits.*

VOLTAGE COMPENSATION LIMIT: (**T03300 only**)   (FAULT) (ALERT)

This fault indicates that the %I firing mode could not fully compensate for a large swing in line voltage. (The processor can provide weld current in a range from 20% to 99%I. However, AVC faults may occur if the programmed range is at or near these limits.)

INSUFFICIENT LINE VOLTAGE: (**T03300 only**)   (FAULT) (ALERT)

This fault indicates that the weld initiate was removed or time expired while the control waited for the programmed line voltage (in Function #72 or #73).

EXTENDED WELD: (FAULT) (ALERT)

This fault is generated under one of two conditions, based on which REWELD function appears in the weld schedule:

- If the schedule contains the function REWELD IF CURRENT LESS THAN 00000 AMPS, this indicates that the control was not able to provide the desired secondary current during the weld, and performed an unsuccessful reweld.

- If the schedule contains the function REWELD IF LOW CURRENT LIMIT FAULT, this indicates that the control performed a reweld, and the desired current *was* provided during the reweld.

ISO CNTR OFF WHEN NEEDED: (FAULT)

The isolation contactor was not pulled in when required by the weld schedule. This parameter is NOT programmable.

This fault is generated when the control detects that the isolation contactor is open when it is trying to execute a weld function. (The contactor must be closed to provide weld current.)

On detecting this condition, the control schedules in No Weld and generates this fault condition. If the control is in No Weld mode, it does not generate a fault.

CURRENT COMPENSATION LIMIT: (FAULT) (ALERT)
(**T03300 only**)   (NONE)

The secondary current provided to a weld is monitored each cycle during an ACC weld function, to provide the desired current to a weld. If necessary, the control adjusts the current provided based on the current read during the previous cycle.

This fault occurs if the control hits a firing limit while trying to obtain the desired current, indicating that it could not compensate for the current drop. It can also occur of the amount of current programmed in the weld function causes the control to fire below 20%I.

ISO CNTR ERR-BRKR TRIPPED: (FAULT)

This fault is generated when the MedWeld 4000 signals to open the isolation contactor (to cut off weld current) but the isolation contactor did NOT open. It can also occur if the isolation contactor is pulled in when a weld initiate is not present.

NO ZERO CROSSING SYNC: (FAULT)

This condition is generated when the control is unable to synchronize with the line voltage. This parameter is NOT programmable. This fault is observed when the circuit breaker is turned off or tripped.

LOW BATTERY: (FAULT) (ALERT)

A battery back-up maintains RAM integrity while the control is powered down. This condition is generated when the control detects that the battery's charge is low. To clear this fault. replace the battery within 30 to 60 days.

HIGH C-FACTOR LIMIT: (FAULT) (ALERT)
LOW C-FACTOR LIMIT: (FAULT) (ALERT)

These two conditions indicate that the actual C-Factor read during the weld exceeded or fell below the values programmed in the C-Factor function (C-FACTOR LIMIT: HI=nnn LOW=nnn).

The low limit is helpful to detect cable and connection deterioration. The upper limit can detect secondary bridges and shunting paths. (Refer to "C-Factor" on page 7-1 for more information.)

SYSTEM COOLING: (FAULT)

This fault is generated if the control receives a valid weld initiate and the TRANSFORMER OVER-TEMPERATURE/SYSTEM COOLING input is not active. This fault is also generated if the SCR thermal switch is tripped.

HEAT CYCLE LIMIT: FAULT)

This fault is generated when the control detects that the number of consecutive weld cycles where conduction occurred exceeded the limit programmed in the Heat Cycle Limit (0=SEAM) setup parameter.

When the limit is exceeded, the weld schedule is finished in No Weld Mode. The control generates a HEAT CYCLE LIMIT fault.

WELD INTERRUPTION: (FAULT) (ALERT)

This fault is generated under three conditions:

- If the control moves into No Weld Mode while sequencing.

- If the control powers down while sequencing.

- If the WTC weld processor loses communication while the control is executing a schedule.

I/O: (**T02300 only**)   (FAULT)

This fault is issued when there has been a loss of communication over a set amount of time and no I/O is being received at the weld processor.

I/O UPDATE TIMEOUT: (**T03300 only**)(FAULT)

This fault may occur in one of these conditions:

- The processor entered Program Mode while the control was executing a weld sequence.

- The WTC weld processor loses communications for more than the time specified in the I/O Update Timeout (mSEC): nnn setup parameter. The fault may be set at any time, including when the control is initiating a schedule. If this occurs, the schedule is aborted.

  When the control is idled and not initiated, the timeout interval is fixed at 10 sec.

- When the weld processor cannot communicate over the rack backplane. If this timeout occurs, major system bus faults are suspect.

- If the weld processor moves out of Run Mode while the control is executing a schedule.

RIO COMM ERROR/NOT IN RUN MODE: (**T03300 only**)   (FAULT)

This fault occurs

- If the host connected to the RIO link moves out of Run Mode, or

- The link encounters a fatal communication error while the control is executing a schedule.

In either case, this fault is flagged regardless of the state of the I/O VALID input.

WELD PROCEED: (FAULT) (ALERT)

This fault is generated if the WELD PROCEED input does not become active within the number of cycles specified in the function WAIT nnn CY. FOR WELD PROCEED.

PRESSURE SWITCH: (FAULT) (ALERT

This fault is generated if the PRESSURE SWITCH input does not become active within the number of cycles specified in Function #68 (WAIT nnn CY. FOR PRESSURE SWITCH) or if the weld initiate is removed while the control is waiting in Function #69 (WAIT FOR PRESSURE SWITCH).

RETRACT PILOT: (FAULT) (ALERT)

> The function VERIFY CYLINDER #n IS OUT OF RETRACT tells the control to confirm that the selected cylinder is out of retract. If the cylinder is NOT out of retract, the control will abort the schedule and generate this fault.

WELDER CURRENT SHUNTING:
(**T03300 only**)   (FAULT) (ALERT)

> This fault is generated when the control detects that a shorted SCR condition occurred for 3 or more consecutive cycles, but less than the programmed value, in the Shorted SCR Cycle Limit setup parameter.

ISO CONTACTOR NOT ENABLED: (FAULT)

> This fault is generated if the isolation contactor is de-activated (opens) while the control is sequencing.

CONTROL IN NO WELD: (FAULT) (ALERT)

> This fault occurs if the control moves from Weld Mode into No Weld Mode while sequencing. This fault is also generated if the control receives a weld initiate while in No Weld Mode.

INVERTER SERIAL COMM ERROR:
(T02300 only)   (FAULT) (ALERT)

> This condition is generated when the weld processor detects a loss of communications with the inverter over the MedLAN cable.

INITIATION ON POWER-UP   (FAULT)

> This fault is set if initiates are present on power-up.

CONTACTOR SHORT: **(T02300 only)** (FAULT) (ALERT)

> This fault occurs when a contactor (other than the one that is currently firing) shows no voltage across its SCR/contactor for more than 2 cycles during the weld and its Short Detection Enable/Disable setup parameter is set to ENABLE (see setups below).

NOTE: *False* CONTACTOR SHORT *faults will occur if a contactor's short detection is set to ENABLED and it has no welding transformer connected, or the currently selected contactor fires below a minimum on-time threshold (approximately 10 percent of the maximum available on-time at 1,200 Hz operating mid-frequency).*

This fault differs from the SHORTED CONTACTOR TRIP fault. It only checks for shorted contactors while welding, *versus* "runaway" inverters that fire on their own.

ANALOG NOT WITHIN WINDOW
(**T02300 only**)   (FAULT)

Certain versions of the program support analog I/O. When this support is included, this setup parameter flags a fault condition if the analog reading from a transducer is not within the specified window tolerances. (For example, you might need to monitor the position and height of die opening for projection welding. However, the I/O functions and this parameter will accept any analog transducer input: Height, displacement, force, pressure, etc.)

PRESSURE NOT ACHIEVED: (**T03300 only**)(FAULT)

Program #T03300 supports analog I/O through an analog card in the chassis. Three setup parameters implement this support.

This fault occurs when the proportional valve pressure (programmed by functions #08, #13 or #14), was not achieved within the number of cycles programmed in Function #09 (WAIT nn CY FOR PRESSURE ACHIEVED).

If the sequence contains more than one valve pressure setting, the processor will only monitor the last pressure function contained in the sequence.

This parameter is permanently set to the FAULT condition. You CANNOT program it.

The following two parameters (along with Sec. Curr Coil Multiplier (x1000)) support operation of the Secondary Current Interface Board (SCIB):

SECONDARY CURRENT COIL/BOARD:
(**T03300 only**)   (FAULT)

This fault will occur under the following conditions:

- If an error occurred while attempting to initialize or configure the SCIB due to a malfunction on the SCIB board or an improper connection to the weld timer.

- If an error occurred during the secondary current calibration process due to an improper connection to the secondary current coil.

- If an error occurred during the secondary calibration process due to a loss of primary power (no zero-crossing synchronization).

- If an error occurred during the secondary calibration process due to a missing current range jumper on the SCIB board.

CURRENT MONITOR MODE: (PRIMARY)
(**T03300 only**)   (SECONDARY)

Select either *primary* or *secondary* current monitoring. If selecting secondary current monitoring, a Secondary Current Interface Board (SCIB) and secondary current-sensing coil must be attached. Refer to Appendix G for a detailed description of the SCIB.

TRANSFORMER TYPE: (AC WOUND)
                                 (DC WOUND)
                                 (AC STACKED)
                                 (DC STACKED)

This parameter has four selections: AC WOUND, AC STACKED, DC WOUND or DC STACKED.

When selecting *AC STACKED* or *DC STACKED*, the first half-cycle of each pulse is fired completely, as required by the weld schedule.

By selecting *AC WOUND* or *DC WOUND*, the control uses delayed firing to prevent damage caused by firing at too great a phase angle on the first cycle of a weld or impulse.

AC regulates on the current that is actually read. DC uses a special algorithm to approximate the current.

CURRENT LIMIT MODE: (**T03300 Only**)(AVERAGE) (PEAK)

This parameter specifies which method the control will use during current limit processing.

- If this parameter is set to *PEAK*, the fault is generated if the current limit is exceeded during any one cycle.

- If set to *AVERAGE*, the control adds the current read during each cycle and divides by the number of cycles to determine average current. The fault is generated only if the average current exceeds the limit.

INITIATION ON FAULT   (INHIBIT) (ALLOW)

This parameter tells the control how to react if it receives a weld initiate when a fault condition is present.

- *INHIBIT* tells the control to ignore the initiate and generate this fault.

- *ALLOW* tells the control to ignore the fault condition and initiate the schedule.

SHORT DETECTION: (**T03300 only**)   (ENABLED) (DISABLED)

This parameter can override the Shorted SCR Cycle Limit and Welder Current Shunting setup parameters.

Setting to *DISABLE* means that NO shorted SCR conditions of any kind will be detected. No faults will be generated.

ENABLE tells the control to check for shorted SCRs. Refer to the discussion of this feature in "SCR Short Detection" on page 7-10.

Danger!

Use this parameter for test purposes only! Disabling the short detection features can cause catastrophic failure and dangerous operating conditions. ALWAYS set this parameter to ENABLED under normal operating conditions.

RETRACT MODE: (LATCHED)
                                 (UNLATCHED)

This parameter tells the control how to react when it receives the RETRACT input:

• *UNLATCHED* tells the control to let the RETRACT output follow the state of the RETRACT input. (When the input is on, the output is ON; when the input is off, the output is OFF.)

• *LATCHED* tells the control to change the state of the RETRACT output when the input is briefly turned on and then off (pulsed).

WARNING!

For safety, the MedWeld 4000 ignores any changes made to this parameter until you reset the control (by cycling power).

CYL: (AIR-NORMAL)
                                                                      (AIR-INVERTED)

This setup parameter defines what type of weld gun cylinder is being used:

- *AIR-NORMAL*—Select this type of cylinder when the machine uses an air-only cylinder, AND the RETRACT output is turned OFF to close the gun.

- *AIR-INVERTED*—Select this type of gun cylinder when the machine uses an air-only cylinder, AND the RETRACT output is turned ON to close the gun.

WARNING!

⚠

For safety, the MedWeld 4000 ignores any changes made to this parameter, until you reset the control (by cycling power).

HIGH POWER FACTOR LIMIT (%): 99 (10–99)
LOW POWER FACTOR LIMIT (%): 10 (10–99)

(T03300 only): These two parameters tell the weld control the range of acceptable values for power factor. If the power factor exceeds or falls below these limits, a HIGH or LOW POWER FACTOR LIMIT fault is generated.

The HIGH POWER FACTOR LIMIT fault can help warn of a deteriorating secondary. A LOW POWER FACTOR LIMIT fault can indicate a control malfunction, or an increase in inductive resistance.

NOTE: *The function* POWER FACTOR LIMIT: HI= NN% LOW= NN% *will override the* High *and* Low Power Factor Limit *setup parameter if programmed in a weld schedule.*

TIPS DOWN TEST FIRE %%I:
(**T03300 only**)   20 (20–99)

The welding schedule uses this value of heat when the control executes the functions VERIFY TIPS DOWN EVERY nn CYC. nn TIMES or SLOW CYLINDER TEST EVERY nn CYC. nn TIMES.

Program the lowest value possible to reduce the open secondary voltage, while keeping this value high enough so that the current detected when tips are down exceeds the Tips Down Verified Current setup parameter.

For more information, refer to the description of this parameter in "Dynamic Squeeze Features" on page 7-6.

VALVE 1 INITIAL PRESSURE (PSI): (**T03300 only**)(nn)
VALVE 2 INITIAL PRESSURE (PSI): (**T03300 only**)(nn)

This parameter lets you set a base pressure for each pressure valve. This sets the initial pressure to be supplied to the valve at power-up and at the end of a weld sequence.

nn sets the pressure in the range 0 – 99 PSI. The default setting is **50** PSI.

HEAT CYCLE LIMIT (0=SEAM):   (0–99)

This parameter defines the maximum number of consecutive cycles of heat conduction. (After nine consecutive cycles without conduction, the heat cycle counter is reset to zero.)

For seam welding applications, disable this function by setting the cycle limit to zero.

ISOLATION CONTACTOR DELAY (SEC): (0–99)

This parameter tells the control how long to hold the isolation contactor pulled in after the function TURN OFF ISOLATION CONTACTOR executes. This is designed to prevent wear on the isolation contactor caused by dropping in and out between welds.

When the ISOLATION CONTACTOR SAVER input is available and set LOW, it disables this delay timer.

NOTE: *The function ISO CONTACTOR DELAY can be inserted into the weld schedule. If written in the weld schedule the function will override this setup parameter, but only applies for that particular weld schedule and when in sequence. If not programmed into a weld schedule all delays for the contact default to the setup parameter. If programmed as a function in the weld schedule the delay function must come before TURN ON ISO CONTACTOR.*

HIGH CURRENT LIMIT WINDOW: (0–99)
LOW CURRENT LIMIT WINDOW: (0–99)

These two parameters define a global current range for every weld schedule.

The MedWeld 4000 calculates the high current window as a percentage boost over the current expected. The low current window is a percentage decrease from the expected current. (The expected current is the base current—programmed in the weld function—plus the current that the stepper is providing.)

For ACC, the base is the actual secondary current value programmed. %I is derived by determining the maximum current deliverable, and the percentage of that current programmed in the weld schedule.

SHORTED SCR CYCLE LIMIT:
(**T03300 only**)   (3–99)

> This parameter sets the maximum number of consecutive cycles where a shorted SCR condition (without current) can occur before the breaker is tripped.

WARNING!

If the control detects a shorted SCR condition with current for four out of seven half-cycles, the control will trip the breaker regardless of the programmed value of this setup parameter. Refer to the description of these features in "SCR Short Detection" on page 7-10.

DATA COLLECTION SAMPLE SIZE: n   (1–99)
DATA COLLECTION SAMPLE
FREQUENCY: nnnn   (1–9999)

> These two parameters set a global command which allows the weld control to sample data for analysis at controlled intervals.

> The sample size is the amount of weld data collected for analysis (number of consecutive welds, per bin). The sample frequency is the total number of welds (per bin) where data is collected (the samples are taken from). See "SPC Indexing Capabilities" on page 7-8 for more information.

TIPS DOWN VERIFIED CURRENT: nnnn
(T03300 0nly)   (0–9999)

> This is the value of current that is used as the threshold when the control executes the functions VERIFY TIPS DOWN nn CY. nn TIMES or SLOW CYLINDER TEST EVERY nn CYC. nn TIMES.

> Determine this value by experimenting to distinguish open and closed secondary currents for various heat settings.

> For more information, refer to the description of this parameter in "Dynamic Squeeze Features" on page 7-6.

TRANSFORMER TURNS RATIO: nnn:1 (1–256:1)

> This parameter tells the control the turns ratio of the welding transformer used. This lets the control determine secondary current during a weld. (Secondary current equals the primary current multiplied by the turns ratio.)

Cautions:

The control uses this value to determine the secondary current provided. Be certain to correctly program this parameter for the operating environment BEFORE attempting to use the weld functions using Automatic Current Compensation (ACC). (**Note:** The TURNS RATIO function allows overriding this parameter setting.)

When programming the control for ACC Firing (Functions #30–34), if you change the turns ratio, the control will require the first two cycles of the next weld to adjust the current.

NOMINAL LINE VOLTAGE: nnn   (100–650)

The control use this parameter to establish a reference point for determining the compensation required for line voltage fluctuations when welding in the %I firing mode.

NOMINAL C-FACTOR: nnn
 (**T03300 only**)   (0–999)

The C-factor represents the value of current obtained or expected for each percentage of maximum current deliverable. The programming device displays the actual C-Factor detected by the MedWeld 4000. You can program the acceptable range of C-factor in a weld schedule.

To determine the nominal C-Factor, first perform a series of welds. Record the actual C-factor displayed at the programming device. Calculate the average, and enter that as the nominal C-factor value.

I/O UPDATE TIMEOUT (MSEC): nnnn
(**T03300 only**)   (0–9999)

This setup parameter programs the maximum length of time in which the WTC weld processor can lose communications while initiating without generating an I/O TIMEOUT fault.

SEC. CURR COIL FACTOR (X1000): nnnn
(**T03300 only**)   (0-9999)

Use this setup parameter when monitoring secondary current as an adjustment to accommodate for secondary current sensing coils of different sensitivities.

Setting this parameter to 1000 will result in accurate secondary current readings for coils of 0.477 μHy mutual inductance (150 mV/kA @ 50 Hz, or 180 mV/kA @ 60 Hz). Setting this parameter *above* 1,000 will increase the reading. Setting *below* 1,000 will decrease the reading.

NOTE: *Sec. Curr Coil Factor is only supported when a secondary current interface board (SCIB) is installed to measure the secondary current from the weld transformer.*

Inverter Fault Status (MFDC - T023xx Softwares)

The setup parameters in this section apply only to programs such as T02300, which use medium frequency direct current welding inverters.

The MFDC inverter generates these fault conditions, based on operating conditions during the weld. They are uploaded to the weld processor via the MedLAN link. They upload either at the end of the weld sequence, or when the processor executes Function #78 (PROCESS WELD FAULTS).

You program these faults from the weld processor, using either the Data Entry Panel or other programming device.

LOW POWER LINE: (FAULT) (ALERT)
                                   (NONE)

The inverter will generate this fault condition when it detects that it was not able to provide sufficient line voltage in the constant primary voltage firing mode. (The Firing Mode setup parameter is set to PRI VOLTAGE.)

SOFT OVERCURRENT: (FAULT) (ALERT)

The inverter generates this condition when it detects that

• The current draw was greater than the rated primary current limit (programmed in the Maximum Primary Current setup parameter), AND

• At least two (but no more than six) mid-frequency half-cycles were terminated because the inverter reached a soft overcurrent limit.

CURRENT REGULATION: (FAULT)(ALERT)
                                       (NONE)

When using the PRI CURRENT firing mode, the inverter will generate this fault condition if it detects that it could not obtain the requested current during three or more consecutive mid-frequency half-cycles.

In all firing modes, the current set point is reached before the masking interval ends on 4 or more consecutive high-frequency half-cycles.

In the PRIMARY I and SECONDARY I firing modes, the Maximum on or Flux Limit is reached on 4 or more consecutive high-frequency half-cycles.

SEC CURRENT SENSOR: (FAULT)(ALERT)
                                          (NONE)

When operating in the SEC CURRENT firing mode, this fault occurs when the inverter detects a shorted, malfunctioning or otherwise defective secondary-current sensor.

WELDING TRANSFORMER: (FAULT)

This fault is generated when either six or more consecutive half-cycles or more than four consecutive mid-frequency half-cycles of the *same* polarity end because the Maximum Primary Current setup parameter was exceeded.

The fault condition will be generated from the PRI VOLTAGE firing mode.

DC BUS OVER VOLTAGE: (FAULT)

This fault condition is generated when the inverter detects that—while no symptoms or problems were generated from the condition—the voltage on the DC bus exceeded the inverter's maximum safe operating range for two consecutive mid-frequency cycles.

INVERTER BUS: (FAULT)

This fault is generated when the inverter detects that the DC bus voltage dropped by more than 40% of the value measured at the start of weld time.

On detecting this condition, the inverter immediately disregards firing signals from the weld processor. The inverter then executes the error shut-down procedure.

CAPACITOR DISCHARGE: (FAULT)

This fault condition is generated when the inverter detects that the energy storage capacitors on the chill plate did not discharge properly when the charging relay isolation contactor dropped out.

CAPACITOR CHARGING: (FAULT)

The inverter generates this fault condition when it detects that the energy storage capacitors could not be charged according to the predicted profile.

CHARGE/DISCHARGE DUTY CYCLE: (FAULT)

The inverter generates this fault on detecting that the application is attempting to operate the isolation contactors at a rate higher than allowed by the de-rating of the discharge resistors.

INVERTER ISO CONTACTOR OFF: (FAULT)

When the inverter receives a firing signal from the weld processor, it checks the status of the TURN ON ISOLATION CONTACTOR input from the weld processor. This input becomes active HIGH. An active signal indicates that the inverter should pull in the charging and mains contactors.

If this input is not active when a firing signal is received, the inverter generates this fault condition to indicate that it did not receive the command to turn on the isolation contactor, and weld current was not provided.

INVERTER OVER TEMP: (FAULT)

This fault indicates that either the energy storage capacitors on the inverter chill plate or the chill plate itself exceeded the recommended temperature.

OUTPUT GROUND: (FAULT)

This fault indicates a current imbalance between the two output terminals of the regulator.

HARD OVERCURRENT: (FAULT)

This fault is generated when the inverter detects a current of up to 10 times the rating of (at least one) IGBT transistor.

DRIVER LOW VOLTAGE: (FAULT)

This inverter generates this condition on detecting a low-voltage condition on one of the four drivers. The inverter immediately performs the error shut-down procedure.

TRANSFORMER DUTY CYCLE: (FAULT)

This fault works with the Transformer Type setup parameter.

If a transformer type is selected in the Transformer Type setup parameter, the duty cycle is compared against the transformer's rating curves for Safe Operating Area. If the curves are exceeded, a fault is set.

TFMR SEC DIODE FAILURE   (FAULT)

If no diode peak is detected in the primary current for three consecutive pulses of the same high-frequency half-cycle phase, a fault is set.

MAXIMUM TIP DRESSES: 60
(0-99)

This parameter defines the maximum number of times the tips may be dressed before the electrode caps must be changed. This sets the starting value for the Tip Dresses Remaining counter.

Each time it receives the TIPS DRESSED input, the control decreases the Tips Dresses Remaining counter by one. When the maximum number of tip dresses remaining is zero, the control activates the CAP CHANGE REQUEST output. This indicates that the tips require maintenance.

Setting this parameter to zero disables the tip dress operation.

Inverter Operating Parameters

The following setup parameters apply only to programs such as T023xx.

TRANSFORMER TYPE: (NONE) (TR75X)
                                           (TR76X)

This parameter tells the weld processor the type of welding transformer being used in the application. The software will check the duty cycle for each welding transformer and use this to alert the operator if the transformer is in danger of saturation from exceeding the duty cycle.

FIRING MODE: (PRI CURRENT)
                                           (PRI VOLTAGE)

• Primary Current: selects the constant current (ACC) firing mode for welds in nnnn0 Amps.

• Primary Voltage: selects the constant primary voltage (AVC) mode for welding in % of current available or %I.

This parameter controls how the inverter will supply weld current. It also sets how fault conditions will be reported if the desired amount of energy could not be delivered to the weld.

NOMINAL LINE VOLTAGE: nnn   (0 - 999)

Nominal line voltage is used by the welding control to set the expected facility power when installed at a location. This parameter (along with the line voltage measurement) is used by the welding control to establish a reference point for determining the compensation required for line voltage fluctuations when welding in the %I firing mode. The value of the nominal line voltage also helps to normalize voltage based calculations for more advanced functions such as C-factor.

This value should be set based on the average voltage of the welding bus.

EXAMPLE: *If the welding bus at the facility is 480 volts, the value of the nominal line voltage should be set to 480. To be more accurate, a line voltage measurement should be taken with a multi-meter during normal working hours or during production. On weekends and during down time a typicaly welding bus can be significantly higher than during production and an accurate reading gives the welding control more accurate information for calculations.*

MAXIMUM PRIMARY CURRENT: NNNN   (0 - 9999)
MAXIMUM SECONDARY CURRENT:NNNNN (0 - 99999)

These parameters set the range of acceptable values used by the MFDC Inverter to determine the amount of weld current to provide, based on the selected firing mode.

Quick Reference to Setup Parameters (T03300)

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The following list shows the default value for each parameter in program #T03300, as programmed at the factory:

INVALID SEQUENCE SELECTED	(FAULT)
WELD INITIATE NOT PRESENT	(ALERT)
CONTROL STOP	(FAULT)
STEPPER APPROACHING MAX	(ALERT)
END OF STEPPER	(FAULT)
HIGH CURRENT LIMIT FAULT	(FAULT)
LOW CURRENT LIMIT FAULT	(FAULT)
SCR MISFIRE	(ALERT)
TIPS NOT TOUCHING	(FAULT)
TIPS TOUCHING	(FAULT)
SLOW CYLINDER FAULT	(ALERT)
INITIAL P.F. OUT OF RANGE	(ALERT)
POWER FACTOR LIMIT	(ALERT)
VOLTAGE COMPENSATION LIMIT	(ALERT)
INSUFFICIENT LINE VOLTAGE	(ALERT)
EXTENDED WELD	(FAULT)
ISO CNTR OFF WHEN NEEDED	(FAULT)
CURRENT COMPENSATION LIMIT	(ALERT)
ISO CNTR ERR-BRKR TRIPPED	(FAULT)
NO ZERO CROSSING SYNC	(FAULT)
LOW BATTERY	(ALERT)
HIGH C-FACTOR LIMIT	(ALERT)
LOW C-FACTOR LIMIT	(ALERT)
SYSTEM COOLING	(FAULT)
HEAT CYCLE LIMIT	(FAULT)
WELD INTERRUPTION	(FAULT)
I/O UPDATE	(FAULT)
RIO COMM ERROR/NOT IN RUN MODE	(FAULT)
WELD PROCEED	(FAULT)
PRESSURE SWITCH	(FAULT)
RETRACT PILOT	(FAULT)
WELDER CURRENT SHUNTING	(ALERT)
ISO CONTACTOR NOT ENABLED	(FAULT)
CONTROL IN NO WELD:	(ALERT)
INITIATION ON POWER-UP	(FAULT)
PRESSURE NOT ACHIEVED	(FAULT)
SECONDARY CURRENT COIL/BOARD	(FAULT)
CURRENT MONITOR MODE	(PRIMARY)
TRANSFORMER	(AC WOUND)
CURRENT LIMIT MODE	(AVERAGE)
INITIATION ON FAULT	(INHIBIT
SHORT DETECTION	(ENABLED)

RETRACT MODE	(LATCHED)
CYL	(AIR-NORMAL)
HIGH POWER FACTOR LIMIT	(99%)
LOW POWER FACTOR LIMIT	(10%)
TIPS DOWN TEST FIRE %I	(20%)
VALVE 1 INITIAL PRESSURE	(50 PSI)
VALVE 2 INITIAL PRESSURE	(50 PSI)
HEAT CYCLE LIMIT (0=SEAM)	(60 CYCLES)
ISOLATION CONTACTOR DELAY	(5 SEC)
HIGH CURRENT LIMIT WINDOW	(20%)
LOW CURRENT LIMIT WINDOW	(20%)
SHORTED SCR CYCLE LIMIT	(60 CYCLES)
DATA COLLECTION SAMPLE SIZE	(5)
DATA COLLECTION SAMPLE FREQUENCY	(100)
TIPS DOWN VERIFIED CURRENT	(10 AMPS)
TRANSFORMER TURNS RATIO	(100:1)
NOMINAL LINE VOLTAGE	(468 VOLTS)
NOMINAL C FACTOR	(999)
I/O UPDATE TIMEOUT	(250 mSEC)
SEC. CURR COIL FACTOR (X1000)	(1000)

Quick Reference to Setup Parameters (T03302)

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The following list shows the default value for each parameter in program #T03302, as programmed at the factory:

INVALID SEQUENCE SELECTED	(FAULT)
WELD INITIATE NOT PRESENT	(ALERT)
CONTROL STOP	(FAULT)
STEPPER APPROACHING MAX	(ALERT)
END OF STEPPER	(FAULT)
HIGH CURRENT LIMIT FAULT	(FAULT)
LOW CURRENT LIMIT FAULT	(FAULT)
SCR MISFIRE	(ALERT)
TIPS NOT TOUCHING	(FAULT)
TIPS TOUCHING	(FAULT)
SLOW CYLINDER FAULT	(ALERT)
INITIAL P.F. OUT OF RANGE	(ALERT)
POWER FACTOR LIMIT	(ALERT)
VOLTAGE COMPENSATION LIMIT	(ALERT)
INSUFFICIENT LINE VOLTAGE	(ALERT)
EXTENDED WELD	(FAULT)
ISO CNTR OFF WHEN NEEDED	(FAULT)
CURRENT REGULATION LIMIT	(ALERT)
ISO CNTR ERR-BRKR TRIPPED	(FAULT)
NO ZERO CROSSING SYNC	(FAULT)
LOW BATTERY	(ALERT)
HIGH C-FACTOR LIMIT	(ALERT)
LOW C-FACTOR LIMIT	(ALERT)
SYSTEM COOLING	(FAULT)
HEAT CYCLE LIMIT	(FAULT)
WELD INTERRUPTION	(FAULT)
I/O UPDATE	(FAULT)
WELD PROCEED	(FAULT)
PRESSURE SWITCH	(FAULT)
RETRACT PILOT	(FAULT)
WELDER CURRENT SHUNTING	(ALERT)
ISO CONTACTOR NOT ENABLED	(FAULT)
CONTROL IN NO WELD:	(ALERT)
INITIATION ON POWER-UP	(FAULT)
PRESSURE NOT ACHIEVED	(FAULT)
SECONDARY CURRENT COIL/BOARD	(FAULT)
CURRENT MONITOR MODE	(PRIMARY)
TRANSFORMER	(AC WOUND)
CURRENT LIMIT MODE	(AVERAGE)
SHORT DETECTION	(ENABLED)
RETRACT MODE	(LATCHED)
CYL	(AIR-NORMAL)

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ANALOG OUTPUT                              (VOLTAGE)
HIGH POWER FACTOR LIMIT                    (99%)
LOW POWER FACTOR LIMIT                     (10%)
TIPS DOWN TEST FIRE %I                     (20%)
VALVE 1 INITIAL PRESSURE                   (50 PSI)
VALVE 2 INITIAL PRESSURE                   (50 PSI)
HEAT CYCLE LIMIT (0=SEAM)                  (60 CYCLES)
ISOLATION CONTACTOR DELAY                  (5 SEC)
HIGH CURRENT LIMIT WINDOW                  (20%)
LOW CURRENT LIMIT WINDOW                   (20%)
SHORTED SCR CYCLE LIMIT                    (60 CYCLES)
DATA COLLECTION SAMPLE SIZE                (5)
DATA COLLECTION SAMPLE FREQUENCY (100)
TIPS DOWN VERIFIED CURRENT                 (10 AMPS)
TRANSFORMER TURNS RATIO                    (100:1)
NOMINAL LINE VOLTAGE                       (468 VOLTS)
NOMINAL C FACTOR                           (999)
SEC. CURR COIL FACTOR (X1000)              (1000)
GUN 1 CLOSE TO PRE-BLOCK POS (CY/2)  (000)
GUN 1 ADVANCE STOP TIME POS (CY/2)   (000)
GUN 1 OPEN FROM BLOCK POS (CY/2)     (000)
GUN 1 CLOSE TO PRE-BLOCK POS (CY/2)  (000)
GUN 2 CLOSE TO PRE-BLOCK POS (CY/2)  (000)
GUN 2 ADVANCE STOP TIME POS (CY/2)   (000)
GUN 2 OPEN FROM BLOCK POS (CY/2)     (000)
GUN 2 CLOSE TO PRE-BLOCK POS (CY/2)  (000)
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Quick Reference to Setup Parameters (T03310)
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The following list shows the default value for each parameter in program #T03310 as programmed at the factory:

INVALID SEQUENCE SELECTED	(FAULT)
WELD INITIATE NOT PRESENT	(ALERT)
CONTROL STOP	(FAULT)
STEPPER APPROACHING MAX	(ALERT)
END OF STEPPER	(FAULT)
HIGH CURRENT LIMIT FAULT	(FAULT)
LOW CURRENT LIMIT FAULT	(FAULT)
SCR MISFIRE	(ALERT)
TIPS NOT TOUCHING	(FAULT)
TIPS TOUCHING	(FAULT)
SLOW CYLINDER FAULT	(ALERT)
INITIAL P.F. OUT OF RANGE	(ALERT)
POWER FACTOR LIMIT	(ALERT)
VOLTAGE COMPENSATION LIMIT	(ALERT)
INSUFFICIENT LINE VOLTAGE	(ALERT)
EXTENDED WELD	(FAULT)
ISO CNTR OFF WHEN NEEDED	(FAULT)
CURRENT REGULATION LIMIT	(ALERT)
ISO CNTR ERR-BRKR TRIPPED	(FAULT)
NO ZERO CROSSING SYNC	(FAULT)
LOW BATTERY	(ALERT)
HIGH C-FACTOR LIMIT	(ALERT)
LOW C-FACTOR LIMIT	(ALERT)
SYSTEM COOLING	(FAULT)
HEAT CYCLE LIMIT	(FAULT)
WELD INTERRUPTION	(FAULT)
I/O	(FAULT)
WELD PROCEED	(FAULT)
PRESSURE SWITCH	(FAULT)
RETRACT PILOT	(FAULT)
WELDER CURRENT SHUNTING	(ALERT)
ISO CONTACTOR NOT ENABLED	(FAULT)
CONTROL IN NO WELD:	(ALERT)
TRANSFORMER	(AC WOUND)
CURRENT LIMIT MODE	(AVERAGE)
SHORT DETECTION	(ENABLED)
RETRACT MODE	(LATCHED)
CYL	(AIR-NORMAL)
ANALOG OUTPUT	(VOLTAGE)
HIGH POWER FACTOR LIMIT	(99%)
LOW POWER FACTOR LIMIT	(10%)
TIPS DOWN TEST FIRE %I	(20%)

HEAT CYCLE LIMIT (0=SEAM)   (60 CYCLES)
ISOLATION CONTACTOR DELAY   (5 SEC)
HIGH CURRENT LIMIT WINDOW   (20%)
LOW CURRENT LIMIT WINDOW   (20%)
SHORTED SCR CYCLE LIMIT   (60 CYCLES)
DATA COLLECTION SAMPLE SIZE   (5)
DATA COLLECTION SAMPLE FREQUENCY (100)
MAXIMUM TIP DRESSES   (50)
TIPS DOWN VERIFIED CURRENT   (10 AMPS)
TRANSFORMER TURNS RATIO   (100:1)
NOMINAL LINE VOLTAGE   (468 VOLTS)
NOMINAL C FACTOR   (999)

Quick Reference to Setup Parameters (T03311)

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The following list shows the default value for each parameter in program #T03311 as programmed at the factory:

INVALID SEQUENCE SELECTED	(FAULT)
WELD INITIATE NOT PRESENT	(ALERT)
CONTROL STOP	(FAULT)
STEPPER APPROACHING MAX	(ALERT)
END OF STEPPER	(FAULT)
HIGH CURRENT LIMIT FAULT	(FAULT)
LOW CURRENT LIMIT FAULT	(FAULT)
SCR MISFIRE	(ALERT)
TIPS NOT TOUCHING	(FAULT)
TIPS TOUCHING	(FAULT)
SLOW CYLINDER FAULT	(ALERT)
INITIAL P.F. OUT OF RANGE	(ALERT)
POWER FACTOR LIMIT	(ALERT)
VOLTAGE COMPENSATION LIMIT	(ALERT)
INSUFFICIENT LINE VOLTAGE	(ALERT)
EXTENDED WELD	(FAULT)
ISO CNTR OFF WHEN NEEDED	(FAULT)
CURRENT REGULATION LIMIT	(ALERT)
ISO CNTR ERR-BRKR TRIPPED	(FAULT)
NO ZERO CROSSING SYNC	(FAULT)
LOW BATTERY	(ALERT)
HIGH C-FACTOR LIMIT	(ALERT)
LOW C-FACTOR LIMIT	(ALERT)
SYSTEM COOLING	(FAULT)
HEAT CYCLE LIMIT	(FAULT)
WELD INTERRUPTION	(FAULT)
I/O	(FAULT)
WELD PROCEED	(FAULT)
PRESSURE SWITCH	(FAULT)
RETRACT PILOT	(FAULT)
WELDER CURRENT SHUNTING	(ALERT)
ISO CONTACTOR NOT ENABLED	(FAULT)
CONTROL IN NO WELD:	(ALERT)
TRANSFORMER	(AC WOUND)
CURRENT LIMIT MODE	(AVERAGE)
SHORT DETECTION	(ENABLED)
RETRACT MODE	(LATCHED)
CYL	(AIR-NORMAL)
ANALOG OUTPUT	(VOLTAGE)
HIGH POWER FACTOR LIMIT	(99%)
LOW POWER FACTOR LIMIT	(10%)
TIPS DOWN TEST FIRE %I	(20%)

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HEAT CYCLE LIMIT (0=SEAM)              (60 CYCLES)
ISOLATION CONTACTOR DELAY              (5 SEC)
HIGH CURRENT LIMIT WINDOW              (20%)
LOW CURRENT LIMIT WINDOW               (20%)
SHORTED SCR CYCLE LIMIT                (60 CYCLES)
DATA COLLECTION SAMPLE SIZE            (5)
DATA COLLECTION SAMPLE FREQUENCY       (100)
MAXIMUM TIP DRESSES                    (50)
TIPS DOWN VERIFIED CURRENT             (10 AMPS)
TRANSFORMER TURNS RATIO                (100:1)
NOMINAL LINE VOLTAGE                   (468 VOLTS)
NOMINAL C FACTOR                       (999)
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Quick Reference to Setup Parameters (T02300)

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The following list shows the default value for each parameter in program #T02300, as programmed at the factory:

INVALID SEQUENCE SELECTED	(FAULT)
WELD INITIATE NOT PRESENT	(ALERT)
CONTROL STOP	(FAULT)
STEPPER APPROACHING MAX	(ALERT)
END OF STEPPER	(FAULT)
HIGH CURRENT LIMIT FAULT	(FAULT)
LOW CURRENT LIMIT FAULT	(FAULT)
CONTROL FAILED TO FIRE	(ALERT)
EXTENDED WELD	(FAULT)
ISO CNTR OFF WHEN NEEDED	(FAULT)
ISO CNTR ERR-BRKR TRIPPED	(FAULT)
NO ZERO CROSSING SYNC	(FAULT)
LOW BATTERY	(ALERT)
HIGH C-FACTOR LIMIT	(ALERT)
LOW C-FACTOR LIMIT	(ALERT)
SYSTEM COOLING	(FAULT)
HEAT CYCLE LIMIT	(FAULT)
WELD INTERRUPTION	(FAULT)
I/O	(FAULT)
WELD PROCEED	(FAULT)
PRESSURE SWITCH	(FAULT)
RETRACT PILOT	(FAULT)
ISO CONTACTOR NOT ENABLED	(FAULT)
CONTROL IN NO WELD:	(ALERT)
INVERTER SERIAL COMM ERROR	(FAULT)
INITIATION ON POWER-UP	(FAULT)
CONTACTOR SHORT	(FAULT)
ANALOG NOT WITHIN WINDOW	(FAULT)
LOW POWER LINE	(ALERT)
SOFT OVERCURRENT	(ALERT)
CURRENT REGULATION	(ALERT)
SEC CURRENT SENSOR	(ALERT)
WELDING TRANSFORMER	(FAULT)
DC BUS OVER VOLTAGE	(FAULT)
INVERTER BUS	(FAULT)
CAPACITOR DISCHARGE	(FAULT)
CAPACITOR CHARGING	(FAULT)
CHARGE/DISCHARGE DUTY CYCLE	(FAULT)
INVERTER ISO CONTACTOR OFF	(FAULT)
INVERTER OVER TEMP	(FAULT)
OUTPUT GROUND	(FAULT)
HARD OVERCURRENT	(FAULT)

```
DRIVER LOW VOLTAGE                   (FAULT)
TFMR DUTY CYCLE                      (FAULT)
TFMR SEC DIODE FAILURE               (FAULT)
INITIATION ON FAULT                  (INHIBIT
RETRACT MODE                         (LATCHED)
CYL                                  (AIR-NORMAL)
HEAT CYCLE LIMIT (0=SEAM)            (60)
ISOLATION CONTACTOR DELAY (SEC)      (10)
HIGH CURRENT LIMIT WINDOW            (20%)
LOW CURRENT LIMIT WINDOW             (20%)
DATA COLLECTION SAMPLE SIZE          (05)
DATA COLLECTION SAMPLE FREQUENCY(0100)
TRANSFORMER TURNS RATIO              (1:073)
MAXIMUM TIP DRESSES                  (000)
TRANSFORMER TYPE                     (NONE)
FIRING MODE                          (PRI CURRENT)
NOMINAL LINE VOLTAGE                 (468)
SEC SENSOR mV PER 1000A.             (150)
SEC SENSOR FREQUENCY                 (050)
OPERATING HIGH FREQUENCY             (1200)
MAXIMUM FLUX                         (0200)
MAXIMUM PRIMARY CURRENT              (0300)
MAXIMUM SECONDARY CURRENT            (20000)
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Quick Reference to Setup Parameters (T02301)

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The following list shows the default value for each parameter in program #T02301, as programmed at the factory:

INVALID SEQUENCE SELECTED (FAULT)
WELD INITIATE NOT PRESENT (ALERT)
CONTROL STOP (FAULT)
STEPPER APPROACHING MAX (ALERT)
END OF STEPPER (FAULT)
HIGH CURRENT LIMIT FAULT (FAULT)
LOW CURRENT LIMIT FAULT (FAULT)
CONTROL FAILED TO FIRE (NONE)
EXTENDED WELD (FAULT)
ISO CNTR OFF WHEN NEEDED (FAULT)
ISO CNTR ERR-BRKR TRIPPED (FAULT)
NO ZERO CROSSING SYNC (FAULT)
LOW BATTERY (ALERT)
HIGH C-FACTOR LIMIT (ALERT)
LOW C-FACTOR LIMIT (ALERT)
SYSTEM COOLING (FAULT)
HEAT CYCLE LIMIT (FAULT)
WELD INTERRUPTION (FAULT)
I/O (FAULT)
WELD PROCEED (FAULT)
PRESSURE SWITCH (FAULT)
RETRACT PILOT (FAULT)
ISO CONTACTOR NOT ENABLED (FAULT)
CONTROL IN NO WELD: (ALERT)
INVERTER SERIAL COMM ERROR(FAULT)
INITIATION ON POWER-UP (FAULT)
CONTACTOR SHORT(FAULT)
PRESSURE NOT ACHIEVED (FAULT)
LOW POWER LINE (ALERT)
SOFT OVERCURRENT (ALERT)
CURRENT REGULATION (ALERT)
SEC CURRENT SENSOR (NONE)
WELDING TRANSFORMER (FAULT)
DC BUS OVER VOLTAGE (FAULT)
INVERTER BUS (FAULT)
INVERTER OVER TEMP (FAULT)
OUTPUT GROUND (FAULT)
HARD OVERCURRENT(FAULT)
LOW VOLTAGE (FAULT)
INVERTER SYSTEM FAILURE(FAULT) *NON-RESETTABLE
ILLEAGAL POWER FREQ. (FAULT) *NON-RESETTALBE
MAIN FUSE OPEN (FAULT) *NON-RESETTALBE
SEC. CURRENT SENSOR (NONE)
INCOMPATIBLE HARDWARE (FAULT)
INITIATION ON FAULT (INHIBIT

RETRACT MODE (LATCHED)
CYL (AIR-NORMAL)
ANALOG OUTPUT (VOLTAGE)
HEAT CYCLE LIMIT (0=SEAM) (60)
ISOLATION CONTACTOR DELAY (SEC)(10)
HIGH CURRENT LIMIT WINDOW (20%)
LOW CURRENT LIMIT WINDOW (20%)
DATA COLLECTION SAMPLE SIZE(05)
DATA COLLECTION SAMPLE FREQUENCY(0100)
MAXIMUM TIP DRESSES (000)
MAXIMUM LINE PRESSURE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
TRANSFORMER TYPE (NONE)
FIRING MODE (PRI CURRENT)
MAXIMUM PRIMARY CURRENT (0400) [TYPE 2 NADEX INV]
W.T. ON PRIMARY CURRENT (ENABLE)
PULSE WIDTH LIMIT (99)
MILLISECOND ON TIME (0)
MILLISECOND OFF TIME (0)
NOMINAL LINE VOLTAGE (468)
SEC SENSOR MV PER 1000A. (150)
SEC SENSOR FREQUENCY (050)
OPERATING HIGH FREQUENCY (1200)
MAXIMUM FLUX (0200)
MAXIMUM PRIMARY CURRENT (0300) [TYPE 1 MEDAR INV]
SOFT OVERCURRENT LIMIT (400A)
TRANSFORMER TURNS RATIO (1:073)
MAXIMUM SECONDARY CURRENT (20000)

Quick Reference to Setup Parameters (T02302)

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The following list shows the default value for each parameter in program #T02302, as programmed at the factory:

INVALID SEQUENCE SELECTED (FAULT)
WELD INITIATE NOT PRESENT (ALERT)
CONTROL STOP (FAULT)
STEPPER APPROACHING MAX (ALERT)
END OF STEPPER (FAULT)
HIGH CURRENT LIMIT FAULT (FAULT)
LOW CURRENT LIMIT FAULT (FAULT)
CONTROL FAILED TO FIRE (NONE)
EXTENDED WELD (FAULT)
ISO CNTR OFF WHEN NEEDED (FAULT)
ISO CNTR ERR-BRKR TRIPPED (FAULT)
NO ZERO CROSSING SYNC (FAULT)
LOW BATTERY (ALERT)
HIGH C-FACTOR LIMIT (ALERT)
LOW C-FACTOR LIMIT (ALERT)
SYSTEM COOLING (FAULT)
HEAT CYCLE LIMIT (FAULT)
WELD INTERRUPTION (FAULT)
I/O (FAULT)
WELD PROCEED (FAULT)
PRESSURE SWITCH (FAULT)
RETRACT PILOT (FAULT)
ISO CONTACTOR NOT ENABLED (FAULT)
CONTROL IN NO WELD: (ALERT)
INVERTER SERIAL COMM ERROR(FAULT)
INITIATION ON POWER-UP (FAULT)
CONTACTOR SHORT(FAULT)
PRESSURE NOT ACHIEVED (FAULT)
LOW POWER LINE (ALERT)
SOFT OVERCURRENT (ALERT)
CURRENT REGULATION (ALERT)
SEC CURRENT SENSOR (NONE)
WELDING TRANSFORMER (FAULT)
DC BUS OVER VOLTAGE (FAULT)
INVERTER BUS (FAULT)
INVERTER OVER TEMP (FAULT)
CAPACITOR DISCHARGE (FAULT)
CAPACITOR CHARGE (FAULT)
CHARGE / DISCHARGE DUTY CYCLE (FAULT)
OUTPUT GROUND (FAULT)
HARD OVERCURRENT(FAULT)
LOW VOLTAGE (FAULT)
TFMR SEC DIODE FAILURE (FAULT)
TRANSFORMER DUTY CYCLE (FAULT)
INVERTER SYSTEM FAILURE(FAULT) *NON-RESETTABLE

ILLEAGAL POWER FREQ. (FAULT) *NON-RESETTALBE
MAIN FUSE OPEN (FAULT) *NON-RESETTALBE
SEC. CURRENT SENSOR (NONE)
INCOMPATIBLE HARDWARE (FAULT)
INITIATION ON FAULT (INHIBIT
RETRACT MODE (LATCHED)
CYL (AIR-NORMAL)
ANALOG OUTPUT (VOLTAGE)
HEAT CYCLE LIMIT (0=SEAM) (60)
ISOLATION CONTACTOR DELAY (SEC)(10)
HIGH CURRENT LIMIT WINDOW (20%)
LOW CURRENT LIMIT WINDOW (20%)
DATA COLLECTION SAMPLE SIZE(05)
DATA COLLECTION SAMPLE FREQUENCY(0100)
MAXIMUM TIP DRESSES (000)
MAXIMUM LINE PRESSURE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
GUN #1 CLOSE TO PRE-BLOCK POS (20 CY/2)
GUN #1 ADVANCE STOP TIME (20 CY/2)
GUN #1 OPEN FROM BLOCK POS (20 CY/2)
GUN #1 OPEN TO BLOCK POS (20 CY/2)
GUN #2 CLOSE TO PRE-BLOCK POS (20 CY/2)
GUN #2 ADVANCE STOP TIME (20 CY/2)
GUN #2 OPEN FROM BLOCK POS (20 CY/2)
GUN #2 OPEN TO BLOCK POS (20 CY/2)
TRANSFORMER TYPE (NONE)
FIRING MODE (PRI CURRENT)
MAXIMUM PRIMARY CURRENT (0400) [TYPE 2 NADEX INV]
W.T. ON PRIMARY CURRENT (ENABLE)
PULSE WIDTH LIMIT (99)
MILLISECOND ON TIME (0)
MILLISECOND OFF TIME (0)
NOMINAL LINE VOLTAGE (468)
SEC SENSOR MV PER 1000A. (150)
SEC SENSOR FREQUENCY (050)
OPERATING HIGH FREQUENCY (1200)
MAXIMUM FLUX (0200)
MAXIMUM PRIMARY CURRENT (0300) [TYPE 1 MEDAR INV]
SOFT OVERCURRENT LIMIT (400A)
TRANSFORMER TURNS RATIO (1:073)
MAXIMUM SECONDARY CURRENT (20000)

Quick Reference to Setup Parameters (T02304)

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The following list shows the default value for each parameter in program #T02304, as programmed at the factory:

INVALID SEQUENCE SELECTED (FAULT)
WELD INITIATE NOT PRESENT (ALERT)
CONTROL STOP (FAULT)
STEPPER APPROACHING MAX (ALERT)
END OF STEPPER (FAULT)
HIGH CURRENT LIMIT FAULT (FAULT)
LOW CURRENT LIMIT FAULT (FAULT)
CONTROL FAILED TO FIRE (ALERT)
EXTENDED WELD (FAULT)
ISO CNTR OFF WHEN NEEDED (FAULT)
ISO CNTR ERR-BRKR TRIPPED (FAULT)
NO ZERO CROSSING SYNC (FAULT)
LOW BATTERY (ALERT)
HIGH C-FACTOR LIMIT (ALERT)
LOW C-FACTOR LIMIT (ALERT)
SYSTEM COOLING (FAULT)
HEAT CYCLE LIMIT (FAULT)
WELD INTERRUPTION (FAULT)
I/O (FAULT)
ISO CONTACTOR NOT ENABLED (FAULT)
CONTROL IN NO WELD: (ALERT)
INVERTER SERIAL COMM ERROR(FAULT)
INITIATION ON POWER-UP (FAULT)
PRESSURE SWITCH (ALERT)
LOW POWER LINE (ALERT)
SOFT OVERCURRENT (ALERT)
CURRENT REGULATION (ALERT)
SEC CURRENT SENSOR (ALERT)
WELDING TRANSFORMER (FAULT)
DC BUS OVER VOLTAGE (FAULT)
INVERTER BUS (FAULT)
CAPACITOR DISCHARGE (FAULT)
CAPACITOR CHARGING (FAULT)
CHARGE/DISCHARGE DUTY CYCLE (FAULT)
INVERTER ISO CONTACTOR OFF (FAULT)
INVERTER OVER TEMP (FAULT)
OUTPUT GROUND (FAULT)
HARD OVERCURRENT(FAULT)
DRIVER LOW VOLTAGE (FAULT)
TFMR DUTY CYCLE(FAULT)
TFMR SEC DIODE FAILURE (FAULT)
INITIATION ON FAULT (INHIBIT
HEAT CYCLE LIMIT (0=SEAM) (60)
ISOLATION CONTACTOR DELAY (SEC)(10)
HIGH CURRENT LIMIT WINDOW (20%)

LOW CURRENT LIMIT WINDOW (20%)
DATA COLLECTION SAMPLE SIZE(05)
DATA COLLECTION SAMPLE FREQUENCY(0100)
MAXIMUM TIP DRESSES (000)
TRANSFORMER TYPE (NONE)
FIRING MODE (PRI CURRENT)
MAXIMUM PRIMARY CURRENT (0400) [TYPE 2 NADEX INV]
W.T. ON PRIMARY CURRENT (ENABLE)
PULSE WIDTH LIMIT (99)
MILLISECOND ON TIME (0)
MILLISECOND OFF TIME (0)
NOMINAL LINE VOLTAGE (468)
SEC SENSOR MV PER 1000A. (150)
SEC SENSOR FREQUENCY (050)
OPERATING HIGH FREQUENCY (1200)
MAXIMUM FLUX (0200)
MAXIMUM PRIMARY CURRENT (0300) [TYPE 1 MEDAR INV]
SOFT OVERCURRENT LIMIT (400A)
TRANSFORMER TURNS RATIO (1:073)
MAXIMUM SECONDARY CURRENT (20000)

Quick Reference to Setup Parameters (T02306)

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The following list shows the default value for each parameter in program #T02306, as programmed at the factory:

INVALID SEQUENCE SELECTED (FAULT)
WELD INITIATE NOT PRESENT (ALERT)
CONTROL STOP (FAULT)
STEPPER APPROACHING MAX (ALERT)
END OF STEPPER (FAULT)
HIGH CURRENT LIMIT FAULT (FAULT)
LOW CURRENT LIMIT FAULT (FAULT)
CONTROL FAILED TO FIRE (NONE)
EXTENDED WELD (FAULT)
ISO CNTR OFF WHEN NEEDED (FAULT)
ISO CNTR ERR-BRKR TRIPPED (FAULT)
NO ZERO CROSSING SYNC (FAULT)
LOW BATTERY (ALERT)
HIGH C-FACTOR LIMIT (ALERT)
LOW C-FACTOR LIMIT (ALERT)
SYSTEM COOLING (FAULT)
HEAT CYCLE LIMIT (FAULT)
WELD INTERRUPTION (FAULT)
I/O (FAULT)
STAGE 2 / WELD PROCEED (FAULT)
PRESSURE SWITCH (FAULT)
RETRACT PILOT (FAULT)
ISO CONTACTOR NOT ENABLED (FAULT)
CONTROL IN NO WELD: (ALERT)
INVERTER SERIAL COMM ERROR(FAULT)
INITIATION ON POWER-UP (FAULT)
CONTACTOR SHORT(FAULT)
ANALOG NOT WITHIN WINDOW (FAULT)
PRESSURE NOT AVAILABLE (FAULT)
LOW POWER LINE (ALERT)
SOFT OVERCURRENT (ALERT)
CURRENT REGULATION (ALERT)
SEC CURRENT SENSOR (ALERT)
WELDING TRANSFORMER (FAULT)
DC BUS OVER VOLTAGE (FAULT)
INVERTER BUS (FAULT)
CAPACITOR DISCHARGE (FAULT)
CAPACITOR CHARGING (FAULT)
CHARGE/DISCHARGE DUTY CYCLE (FAULT)
INVERTER ISO CONTACTOR OFF (FAULT)
INVERTER OVER TEMP (FAULT)
OUTPUT GROUND (FAULT)
HARD OVERCURRENT(FAULT)
LOW VOLTAGE (FAULT)
TFMR DUTY CYCLE(FAULT)

TFMR SEC DIODE FAILURE (FAULT)
INITIATION ON FAULT (INHIBIT
RETRACT MODE (LATCHED)
CYL (AIR-NORMAL)
HEAT CYCLE LIMIT (0=SEAM) (60)
ISOLATION CONTACTOR DELAY (SEC)(10)
HIGH CURRENT LIMIT WINDOW (20%)
LOW CURRENT LIMIT WINDOW (20%)
DATA COLLECTION SAMPLE SIZE(05)
DATA COLLECTION SAMPLE FREQUENCY(0100)
MAXIMUM TIP DRESSES (000)
MAXIMUM LINE PRESSURE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
STATIC ANALOG 1 OUT VALVE PSI (100)
TRANSFORMER TYPE (NONE)
FIRING MODE (PRI CURRENT)
NOMINAL LINE VOLTAGE (468)
SEC SENSOR MV PER 1000A. (150)
SEC SENSOR FREQUENCY (050)
OPERATING HIGH FREQUENCY (1200)
MAXIMUM FLUX (0200)
MAXIMUM PRIMARY CURRENT (0400)
SOFT OVERCURRENT LIMIT (400A)
TRANSFORMER TURNS RATIO (1:073)
HEAD GRAVITIONAL FORCE LBS. (300)
LOW PRESSURE CLY CAP AREA (28.27*100)
LOW PRESSURE CLY ROD AREA (26.5*100)
HIGH PRESSURE CLY CAP AREA (63.61*100)
HIGH PRESSURE CLY ROD AREA (56.54*100)
MAXIMUM SECONDARY CURRENT (20000)

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Stepper Data 6

The MedWeld 4000 provides *steppers*, to help compensate for changes in the welding environment. These stepper settings are programmable, to control how the weld processor will compensate for these variations.

What is a Stepper?

The MedWeld 4000 provides a *linear* stepper. It adds heat according to a stepper profile that you can program.

You program steppers using the WTC programming device. Tell the weld processor which linear stepper you want to control the weld schedule, by using the stepper assignment function #82. It assigns a stepper number to each linear stepper in the weld schedule.

You can program up to 99 linear steppers. The following sections describe linear steppers, along with directions on how to program them.

You can assign a stepper to a group. This capability allows for incrementing the stepper when the control executes any weld schedule assigned to that group. You can also advance or reset a group of steppers.

Linear Steppers

The conventional linear stepper tracks the number of welds completed. It increases the heat provided to the weld at several programmed set points. This serves to compensate for drifts in the welding process.

The stepper profile consists of a number of linear steps, and a parameter to allow stepper grouping. Each linear step applies additional weld current over a number of welds.

Because the stepper is linear, if a step is programmed to add 3% current over 100 welds, it will actually add 1% after 33 welds, and another 1% after 66 welds. (Heat is added in minimum increments of 1%, based on the function selected.) By the 100th weld, the stepper is adding the full 3% current boost to the amount of current programmed in the weld function.

At the end of a weld schedule, the control will verify the stepper that was activated to see which group it belongs to. The control then bumps up the weld count on all steppers that are associated to the group. (Use the DEP-100S or other programming device to assign steppers to a group.)

For example, if one gun (tips) was used to several different schedules using different steppers, grouping allows you to automatically increment the stepper for every schedule in the group every time the gun is fired.

When the control completes the last weld in the last step, the electrode tips must be dressed and the stepper reset.

To use the linear stepper, you must include Function #82 as the *first* function in the weld schedule.

NOTE: *The stepper is not active during every weld function: it is incremented only when you execute the following functions that provide weld current:*

20	WELD 00 CY 00 %I
25	WELD 00 CY 00.0%I
26	WELD 00 HALF CYCLES 00.0%I
30	WELD 00 CY 00000 AMPS
36	WELD 00 HALF CYCLES 00000 AMPS
40	SLOPE 00 CY 00% TO 00% I
45	SLOPE 00 CY 00000 AMPS TO 00000 AMPS

Default Linear Stepper Profile

As shipped from the factory, the linear steppers use this profile by default:

```
START OF STEPPER
STEP #01 00 % 0000 AMPS 0000 WELDS
STEP #02 00 % 0000 AMPS 0000 WELDS
STEP #03 00 % 0000 AMPS 0000 WELDS
STEP #04 00 % 0000 AMPS 0000 WELDS
STEP #05 00 % 0000 AMPS 0000 WELDS
STEPPER GROUP #01
END OF STEPPER
```

Use one of the programming methods (DEP-100S, WSS or *WebVIEW*) to change the stepper profile to the values required by your application.

Display at the DEP-100S

When you select the Linear Stepper Status display from the DEP-100S, use this display to view the stepper status:

```
/‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾\
  POWER ON                        COMM ON
  ............................................
  LINEAR STEPPER STATUS:
   Boost: +00%           Total Welds=00000
  Step #01                    Step Count=0000
  stpr #01          advance         wcu#00*
  ............................................
      F1          F2          F3          F4
_____/
```

This screen shows the amount of energy being added to each weld function (**Boost**), the current step (**Step**) and the selected stepper (**stpr**), as well as the total weld count and the step count (the number of welds completed during the current step).

From the Stepper Status display,

Press [F1] to see a different stepper

- Press [F3] to advance the stepper

- Press [F4] to see the stepper settings for a different weld processor (**wcu**#)

- Press [F5] to see additional stepper options. The asterisk (*) indicates that additional displays or information are available. When you press [F5], you see the stepper reset option at [F3] ; or

- Press [F5] a second time, and you will see a display showing the status of every linear stepper:

```
/‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾‾\
  POWER ON                        COMM ON
  ............................................
           Stpr   1-8    . . . . . . . .
  STEPPER  Stpr  9-16    . . . . . . . .
  STATUS   Stpr 17-24    . . . . . . . .   *
  ............................................
      F1          F2          F3          F4
_____/
```

- Press [F5] a third time to return to the initial stepper display.

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Advanced Software Features 7

This chapter describes some of the advanced features of the MedWeld 4000 control.

C-Factor

C-Factor is the value of current obtained for each *change* in percentage of the maximum secondary current delivered. C-Factor equals 1% of the total available current during a weld.

The C-Factor can be used in various ways:

- It can be used as a conversion factor between %I values and the actual value of current that would be produced.

- A change in C-Factor will indicate changes in the welding environment.

The actual C-Factor is calculated by the MedWeld 4000 after every weld. The programming device displays this value in the Weld Data display.

The processor calculates C-Factor is by dividing the average secondary current during the weld by the %I fired. The following formula shows this:

$$C\text{-Factor} = I_{pri} \times \frac{n}{\%I} \times \frac{V_{nominal}}{V_{line}} = \frac{I_{sec}}{\%I} \times \frac{V_{nominal}}{V_{line}}$$

where n = transformer turns ratio.

The C-Factor varies with changing conditions in the secondary. Decreasing C-Factor indicates that the total capacity of the system is decreasing. This is evident when the tool current pathways become more resistive. This, in turn, results in deterioration in the secondary circuit. (Two examples of this are cable wear and deterioration of connections.)

Example of Decreasing C-Factor

In an application of shunts in a fixture indexing gun, the guns will pull on the cable. These forces cause strands of wire in the cable to break. As fewer conducting strands remain, the current pathway will decrease, increasing the resistance. This, in turn, will decrease the C-Factor.

This is illustrated by the following data:

- The control is firing the following weld function:
  WELD 10 CYC 10000 A.

- The control required 53% initially to achieve the 10,000 A. Over time, the control actually requires 60% to achieve the desired 10,000 A.

- The initial C-Factor = 10,000 A. / 53% = 189

- Final C-Factor = 10,000 A. / 60% = 167

Conversely, where C-Factor increases, the total capacity of the system is increasing. This increase in C-Factor is associated with shorting/shunting conditions in the welding environment.

When shorting or shunting arises, less resistance is seen because the full current is not passing through the entire welding circuit.

This is a concern. If the full current is not passing through the weld point, a weld below the desired current will occur. Depending on the amount of shunting, the weld nugget may possibly fail to be formed.

Example of Increasing C-Factor

In this example, a robot uses a kickless cable. The robot's motions will cause the cable to twist. As a result, individual wires within the cable will rub against each other.

This action will eventually cause the cable insulation to break down. When this breakdown occurs, the current will start to shunt between wires within the kickless cable.

As this grows, the current at the weld will diminish, and the current pathway will actually decrease. This, in turn, will increase the C-Factor.

This is illustrated by the following data:

- The weld control is firing the following function:
  WELD 10 CYC 65% I

- The control initially sees 12,450 A.

- After the shorting condition occurs, the control may see 14,300 A.

- Initial C-Factor = 12,450 A. / 65% = 192.

- Final C-Factor = 14,300 A. / 65% = 220.

C-Factor can be used to alert the maintenance staff of a welder's deteriorating secondary circuit. You can establish upper and lower C-Factor limits that correspond to a current threshold, to meet the needs of the welding process.

The MedWeld 4000 also provides Function #97 (C-FACTOR LIMIT: HI=000 LO=000) to define the high and low C-Factor limits for a weld schedule. Use to determine when the welding conditions indicate the need for maintenance.

When the weld processor detects that the high or low C-Factor limits were exceeded, it activates the High or Low C-Factor Limit condition (which can be defined as either a Fault or an Alert in the setup parameters).

- Low C-Factor is a monitoring condition and usually defined as an ALERT

- High C-Factor is a welding quality issue, and usually defined as a FAULT.

Low C-Factor Limit

The low C-factor limit detects cable and connection deterioration.

Determining a Low Limit:

Suppose a weld schedule requires 14,000 A. at the end of a stepper program. However, you do not want to exceed 90% of the tool's maximum current capacity.

This means that the lowest full-current capacity of the tool should be 15,555 A. (14000/90=155.555). This makes the low C-Factor limit 155.

High C-Factor Limit

The high C-factor limit can detect secondary shunting paths.

Determining a High Limit

A spot weld requires 10,000 A. The maximum current achievable is 20,000 A. Then the C-Factor is 200.

However, if shunting conditions are simulated and the welds become substandard at C-Factor of 230, then the High C-Factor limit can be set to 230.

Dynamic Current Windows

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You can define a window of acceptable values for current. To define this window, use the setup parameters: High Current Limit and Low Current Limit.

These parameters, along with the Nominal C-Factor parameter, define the acceptable range of current to expect. You can also override the values in the setup parameters by inserting into the weld schedule Function #84 (WINDOW: HI=+00% LO=00% C-FACTOR=000).

Function #84 defines a current limit window with high and low limit values and a new nominal C-Factor. (Refer to the discussion of C-Factor on page 7-1.)

The target current is determined by the firing mode used by the weld function: %I or automatic current compensation. This calculation is shown below:

AVC:
Target current =
(%I programmed in Function #20 + stepper boost) x C-Factor

ACC:
Target current =
A. programmed in Function #30 + stepper boost

Calculate the high and low current limits using this equation:

$$\text{Limit} \ = \ \text{Target current} \pm \left(\text{Target current} \times \frac{\text{HI } or \text{ LO Limit percentage}}{100 \ \%} \right)$$

AVC Example

In this mode, the target value is determined by the following calculation:

Target current =
%I in Function #20 + Stepper boost x C-factor

An example of how these calculations are used is shown below:

• Function #20 is WELD 10 CY 50%I

• Stepper Boost is 2%

• C-Factor is 170

• High Current Limit = 10%

• Low Current Limit = 20%.

To determine the target current:

Target current =
(%I programmed in Function #20 + Stepper boost) x C-Factor

= (50 + 2) x 170 = 8,840 A.

To determine the High Current Limit:

High Current Limit = Target + (Target x %High Limit/100)

= 8,840 + (8,840 x 10/100)
= 8,840 + (884) = 9,724 A.
To determine the Low Current Limit:

Low Current Limit = Target − (Target x %Low Limit/100)

= 8,840 − (8,840 x 20/100)
= 8,840 − (1,768) = 7,072 A.

ACC Firing Mode

In this firing mode, the target value is established by the following calculation:

Target current = A. in Function #30 + Stepper boost

An example of how these calculations are used is shown below.

- Function #30 is WELD 08 CY 11000 A. SEC

- Stepper Boost is 700 A. SEC

- High Current Limit = 10%

- Low Current Limit = 20%

To determine the Target Current:

Target current = A. in Function #30 + stepper boost

= 11,000 + 700 = 11,700 A.

To determine the High Current limit:

High Current Limit = Target + (Target x %High limit/100)

= 11,700 + (11,700 x 10/100)
= 11,700 + (1170) = 12,870 A.

To determine the Low Current Limit:

Low Current Limit = Target − (Target x %Low limit/100)

= 11,700 − (11,700 x 20/100)
= 11,700 − 2,340 = 9,360 A.

Dynamic Squeeze Features

. . . .

The MedWeld 4000 provides a test fire function. Use it to determine the initial secondary resistance of a test fire, and whether the electrode tips were touching, (based on current draw).

The data generated by the test fire can be used by the control in several ways.

Specifying the Test Fire Current

First, use the setup parameter Tips Down Test Fire %I to tell the processor the amount of heat to use in the welding schedule when the control executes Function #80 (VERIFY TIPS DOWN EVERY nn CYC. nn TIMES) or Function #81 (SLOW CYLINDER TEST EVERY nn CYC. nn TIMES).

Set this parameter value to be low enough to reduce the open secondary voltage, but high enough so that the current detected when tips are down exceeds the Tips Down Verified Current setup parameter.

NOTES: DO NOT *confuse the* Tips Down Test Fire %I *setup parameter with Function #39 (TEST FIRE nn%). This setup parameter is used ONLY by the* VERIFY TIPS DOWN *and* SLOW CYLINDER TEST *functions.*

Function #39 performs a 1-cycle test fire at the percent heat programmed. The test functions (described on page 7-6) use the results of this test fire to check conditions such as initial power factor and the amount of current provided by the weld.

Defining the Current Threshold

You must also define the setup parameter Tips Down Verified Current to define the current threshold to use when executing the dynamic squeeze functions: Function #80 (VERIFY TIPS DOWN nn CY. nn TIMES) or Function #81 (SLOW CYLINDER TEST EVERY nn CYC. nn TIMES).

The best way to determine this value is by experimenting to distinguish open and closed secondary currents for various heat settings.

Dynamic Squeeze Functions

Once you define the dynamic current setup parameters, use the following functions with the test fire function in a weld schedule, as described below:

80   VERIFY TIPS DOWN EVERY nn CY nn TIMES

This function uses the dynamic squeeze capabilities to verify that the electrode tips are making full contact with the workpiece. The control fires one cycle of weld current at 20%. It then monitors the weld current provided and determines the power factor.

This is compared to the value programmed in the Tips Down Verified Current setup parameter, (described on page 5-14). If the primary current detected *exceeds* the programmed value, the control proceeds to the next function in the weld schedule.

If the current is *less* than the value programmed, the control waits for the number of cycles programmed (nn CY), then repeats the test fire. This wait-and-fire process continues up to the programmed number of tries (nn TIMES).

If the current never reaches the value programmed, the control generates a TIPS NOT TOUCHING fault and sequences in No Weld.

81   SLOW CYLINDER TEST EVERY nn CY nn TIMES

This function is nearly identical to Function #80, but reports a different fault and will schedule in Weld mode even when it detects a fault.

If the primary current detected by the control *exceeds* that set in the Tips Down Verified Current: nnnn setup parameter, it proceeds to the next function in the weld schedule.

If the current is *less than* the setup parameter, the control waits the number of cycles programmed (nn CY), then repeats the test fire. If the current never reaches the setup parameter limit, the control continues the schedule in Weld Mode, but generates a SLOW CYLINDER fault to indicate the condition.

SPC Indexing Capabilities

. . . .

With **SPC** (Statistical Process Control) **Indexing**, the control collects weld data in temporary storage bins. This data can be collected either in controlled intervals or continuously (in special situations such as tear-down).

Analyzing the collected weld data can help recognize certain welding trends such as changes in resistance of the work piece, primary current and line voltage. You can then use the WTC XWSS (Weld Support System) to retrieve and analyze the stored data.

To perform SPC indexing, use the following functions in a weld schedule, along with the SPC setup parameters described below.

SPC Functions

87   SET SPC OFFSET TO nn

For the purpose of data collection, each weld is assigned a data storage bin number (00 – 99). This function establishes the starting bin number for SPC indexing. Here is an example:

<u>Car Type #1:</u>
Weld Schedule #20 - (SET SPC OFFSET TO 01)
Weld Schedule #01 - 15 Welds Made (Bins 1–15)
Weld Schedule #02 - 15 Welds Made (Bins 16–30)
Weld Schedule #03 - 18 Welds Made (Bins 31–48)

<u>Car Type #2:</u>
Weld Schedule #21 - (SET SPC OFFSET TO 51)
Weld Schedule #04 - 12 Welds Made (Bins 51–62)
Weld Schedule #05 - 12 Welds Made (Bins 63–74)
Weld Schedule #06 - 14 Welds Made (Bins 75–88)

After establishing a bin number, the program stores the data for each weld made in its own individual bin. The bin numbers increase by one each time a weld is made, until another schedule with a different offset is executed.

Bin #99 is the last usable bin. If the weld control reaches bin #99 and is still collecting data, the data for each weld will be stored in bin #99 until a new offset is assigned, therefore making the data unsuitable for analysis.

NOTE: *This function does* NOT *tell the control to collect weld data. It only assigns a data storage bin number. Refer to the Data Collection Sample Size and Data Collection Sample Frequency setup parameters described below for instructions on how to specify data collection.*

88   SEND ALL SAMPLES UNTIL NEXT SPC OFFSET

This function tells the control to start collecting data for all welds. This function should follow the SPC Offset function in the weld schedule because it is still necessary to assign a starting bin number.

Weld data collection continues until the control executes another schedule containing this function (without the offset function), to reset the global data collection process.

This function *overrides* the global Data Collection Sample Size and Data Collection Sample Frequency setup parameters. These are described next.

Caution:

This function is NOT designed for use in a normal production run. It is intended for special situations (such as tear-down) which require continuous data collection.

SPC Setup Parameters

DATA COLLECTION SAMPLE SIZE: 05   (1–99)
DATA COLLECTION SAMPLE FREQUENCY:0100(1–9999)

These two parameters set a global command which allows the weld control to sample data for analysis at controlled intervals.

The sample size is the amount of weld data collected for analysis (number of consecutive welds, per bin). The sample frequency is the total number of welds per bin, where data was collected (the samples are taken from).

For example, by setting the Data Collection Sample Size parameter to 2 and the Data Collection Sample Frequency parameter to 8, the control will collect weld data for 2 consecutive welds (in bin #1), and flag the XWSS to retrieve the data. It will then collect data for 6 more cycles (without flagging XWSS) before starting the process again.

The example table on the next page is for Bin #1 ONLY.

Sample/ Frequency	WCU Process	WIS/WSS Process
1/8	Data flagged for retrieval	Data uploaded
2/8	Data flagged for retrieval	Data uploaded
3/8	Data collected	Data ignored
4/8	Data collected	Data ignored
5/8	Data collected	Data ignored
6/8	Data collected	Data ignored
7/8	Data collected	Data ignored
8/8	Data collected	Data ignored
1/8	Data flagged for retrieval	Data uploaded
2/8	Data flagged for retrieval	Data uploaded
3/8	Data collected	Data ignored
4/8	Data collected	Data ignored
5/8	Data collected	Data ignored
6/8	Data collected	Data ignored
7/8	Data collected	Data ignored
8/8	Data collected	Data ignored

NOTE: *Weld Data Collection is bin dependent. Each bin has its own independent counter and is uploaded to XWSS separately.*

SCR Short Detection

· · · · · · · · · · · ·

The MedWeld 4000 provides two parameters to aid in detecting either shunting current or a shorted SCR.

By setting the Short Detection setup parameter to ENABLE, the processor continuously monitors the primary voltage across the SCRs when the control is not executing a weld function.

Danger!

DO NOT disable short detection (by setting this parameter to DISABLE) for normal operating conditions.

When disabling short detection, the control will not shunt trip the circuit breaker in case of an SCR short. The control will not detect situations such as a catastrophic SCR failure. This can cause tool damage, and create the potential for serious injury or death.

When the processor detects no voltage drop across the SCRs during four out of seven half-cycles, it examines the primary current to determine whether the drop was due to a shorted SCR:

• Primary current *exceeding* a preset amperage indicates a shorted SCR. The weld processor *immediately* generates a SHORTED SCR fault.

• If the primary current is *less than* a preset amperage, the processor checks the SCR Cycle Limit parameter to determine whether the voltage drop was due to a shorted SCR or shunting current.

• The SCR Cycle Limit parameter sets the maximum number of consecutive cycles where a shorted SCR condition (without current) can occur before the breaker is tripped. The control then generates the appropriate fault (either SHORTED SCR or CURRENT SHUNTING).

WARNING!

If the control detects a shorted SCR condition with current for four out of seven half-cycles, the control will trip the breaker, regardless of the programmed value of this setup parameter.

• If the control detects no primary current for 3 or more consecutive cycles, it generates the WELDER CURRENT SHUNTING fault. (If the SCR is shorted or current is shunting, primary current will not be detected.) This fault conditions indicates that shunting was detected for more than 3 cycles *but less than* the number of cycles programmed in the Shorted SCR Cycle Limit setup parameter.

NOTE: *These parameters check different conditions. Shorted Cycle Limit checks for shorted conditions when current is applied. Weld Current Shunting checks for problems when primary current is NOT detected.*

Retract Features

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This section describes in detail how the retract operation is used to provide support for the air only and air over oil cylinders. It also describes how the operation of retract is affected by certain functions and programmable setup parameters, which control the operation of:

• Retract Mode

• Initiate from Retract

• Cylinder Type

WARNING!

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For safety, the MedWeld 4000 ignores any changes to these parameter settings until power is removed from the control. The control checks the status of these parameters only at power-up.

Retract Mode

The Retract Mode setup parameter determines how the control responds to the presence of an active RETRACT PILOT input.

• *UNLATCHED* tells the control to let the output for the Retract Valve (or Blocking valve, for air-over-oil cylinders) follow the state of the RETRACT PILOT input. The output will be active while the input is active.

RETRACT PILOT Input ⎯⎯⎯⎯⎯⎯⎯⎯⎯

RETRACT VALVE Output ⎯⎯⎯⎯⎯⎯⎯⎯⎯
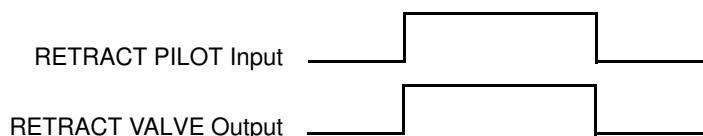
- *LATCHED* tells the control to change the state of the output each time it receives a pulse from the RETRACT PILOT input. The control expects a brief pulse from the input, such as from a pushbutton.

RETRACT PILOT Input

RETRACT VALVE Output
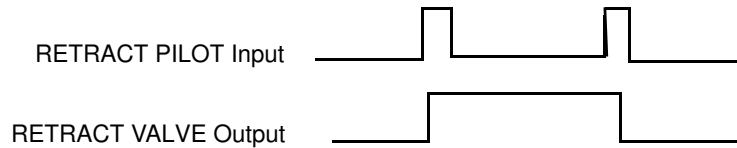
NOTE: *When selecting* LATCHED *retract, it may be necessary to toggle the state of the* RETRACT PILOT *input at power-up (to change the state of the* RETRACT VALVE *output). This will be required if the control powers up in the incorrect retract state, or if the of the* RETRACT PILOT *input status changes while the control is in a C-Stop condition (the* CONTROL STOP *input is* LOW*).*

Cylinder Type

This parameter defines the type of gun cylinder the control application is using. This parameter defines the retract operation, as shown below:
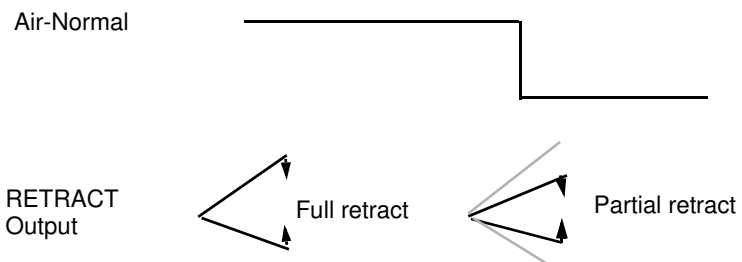
Air-Only Cylinders:

For air-only cylinders, two valves control the weld gun: The Weld valve and the Retract valve.

- The **Retract** valve allows the gun to close to a set gap position. A spring or a second return valve usually returns the gun to the full open position.

- The **Weld** valve closes the gun under the welding air pressure.

Air-only cylinders are identified as shown below in the Cylinder Type setup parameter:

- **AIR-NORMAL** informs the control that the gun is an air-only cylinder using "normal" retract. The output is turned OFF to close the gun.

Air-Normal

RETRACT Output   Full retract   Partial retract

- **AIR-INVERTED** indicates an air-only cylinder, but the output is turned ON to close the gun.

Air-Inverted

RETRACT Output

Full retract   Partial retract
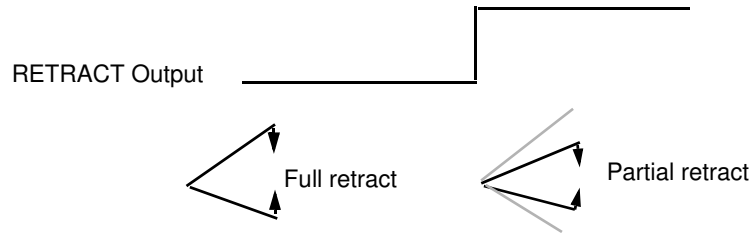
NOTE: *Selecting* AIR-ONLY *in the Cylinder Type setup parameters disables the outputs associated with the air-over-oil cylinder. These outputs, control the advance, intensify and blocking valves. They do* NOT *turn on when the air-only cylinders are selected.*

Air Over Oil Cylinders:

In an air-over-oil cylinder, *three* valves control the gun's position: The Advance, Intensify and Blocking valves.

- Operating the **Advance** valve closes the gun under hydraulic pressure. This allows a softer touch-down, to extend the life of the gun shanks.

- The **Intensify** valve adds welding pressure to the gun.

- The **Blocking** valve can either allow oil to flow or inhibit oil flow. Since this valve can be used to inhibit the flow of oil at any point in the gun stroke, it allows for a variable gun opening.

NOTE: *Selecting* AIR-ONLY *in the* Cylinder Type *setup parameter disables these valves. These outputs control the Advance, Intensify and Blocking valves. They do* NOT *turn on when the air-only cylinders are selected.*

The air-over-oil cylinder is identified as shown below in the Cylinder Type setup parameter:

- *AIR/OIL–NO* tells the control that the weld gun uses an air-over-oil cylinder with a normally-open (NO) blocking valve. The BLOCKING VALVE output is energized (HIGH) to inhibit oil flow.

- *AIR/OIL–NC* signifies that the cylinder is air-over-oil with a normally-closed (NC) blocking valve. The BLOCKING VALVE output is de-energized (LOW) to inhibit oil flow.

Three timers control the action of the air-over-oil cylinder, and are programmed in the setup parameters. The proper settings for these timers may require some trial and error, because the timing will affect the gun's position.

These three timers are described below:

EXTEND SQZ FROM RETRACT #n (CY/2) (See page 5-11.)

This parameter is the length of time to allow the gun to move from the full retract to the full closed position, as shown below:

Extend Squeeze Timer:

full retract   full closed

This allows the control to fire a weld schedule from the full retract position. This setup parameter is added to the time programmed in the function TURN ON ADVANCE VALVE #n in the weld sequence.
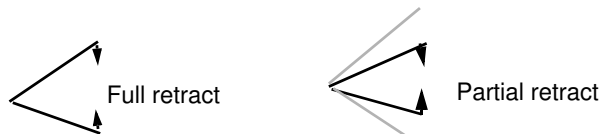

Caution:
This timer controls the gun's position BEFORE the Intensify valve is turned on. If this timer is set too low, the gun may not close fully. In addition, the gun may close but fail to return to the full open position, depending on the amount of squeeze in the TURN ON ADVANCE VALVE function. This will decrease any gap opening that is used further down the line.

PARTIAL RETRACT #n DELAY (CY/2) (See page 5-11.)

This is the length of time to allow for the gun to move from the fully-retracted position to the partial retract position, as shown below:

Partial Retract Delay Timer:

Full retract   Partial retract

Cautions:

This timer will determine the partial retract opening. The size of the opening **increases** as you reduce the length of time; it **decreases** as you increase the length of time. If the control does not start from the full open position each time, the partial retract opening may vary in size.

A heavy gun will have difficulty maintaining a constant partial retract position as the gun's orientation changes. (The heavier the gun, the more difficulty in maintaining a constant opening size in vertical versus horizontal orientations.)

BLOCKING VALVE #n DELAY (CY/2) (See page 5-11.)

This parameter sets the length of time to allow for the gun to move from the fully-closed position to the partial retract position, as shown below:

Blocking Valve Delay Timer:

Fully closed   Partial retract
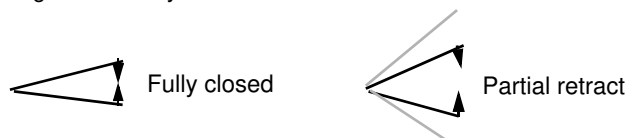
Caution:

This timer controls the size of the return partial retract opening. If this value is set too high, the gun's opening will increase as the control is initiated from the partial retract position. This will cause the gun to walk away from the part, and eventually
fail to completely close.

Examples

Full to Partial Retract:

The weld processor controls both the Advance and Blocking valves to move the gun from the full retract position to the partial retract position. This action is initiated by the RETRACT input. See "Initiation From Retract" on page 7-21.

The Blocking valve is dis-engaged (based on the Cylinder Type setup parameter: Normally Open or Normally Closed). The Advance valve will be energized for the length of time specified in the Partial Retract #n Delay setup parameter illustrated above. Then, the Blocking valve is re-energized. (This allows the gun to move from the full retract to the partial retract position). This is illustrated here:

**Normally-Open (NO) Blocking Valve, full to partial retract:**
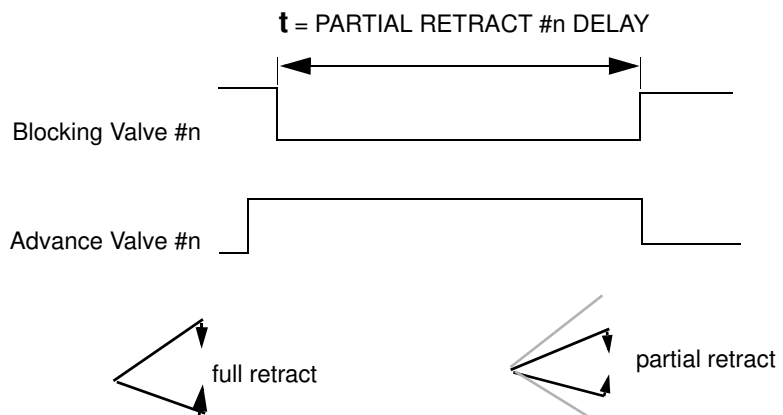
Partial Retract to Full Retract:

In this case, the weld control uses the blocking valve to move the gun from the partial retract position to the fully-retracted position. This action is initiated by the retract input (as described in "Initiation From Retract" on page 7-21).

The blocking valve is dis-engaged (based on the CYLINDER TYPE setup parameter: normally open or normally closed), to allow the oil to flow back into the reservoir.

This is illustrated in the drawing below:

Normally-Open (NO) Blocking Valve, partial to full retract:
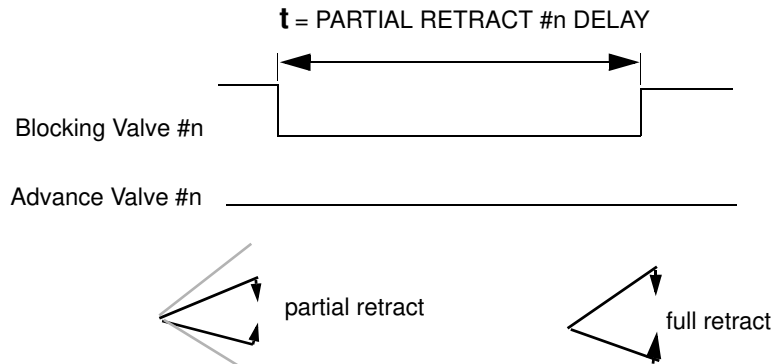
Example Weld Schedule: Air Over Oil Cylinder Operation

82	LINEAR STEPPER #01 ASSIGNED (0=OFF)
80	VERIFY CYLINDER #1 IS OUT OF RETRACT
62	REPEAT (AT NEXT FUNCTION)
17	TURN ON ADVANCE VALVE #1 SQZ **20** CY
18	TURN ON INTENSIFY VALVE SQZ **10** CY
20	WELD 10 CYCLES 50%I
78	PROCESS WELD FAULTS
03	HOLD 05 CYCLES
19	TURN OFF INTENSIFY/ADV VALVE #1
04	OFF 10 CYCLES
82	LINEAR STEPPER #00 ASSIGNED (0=OFF)
80	VERIFY CYLINDER #n IS OUT OF RETRACT
62	REPEAT (AT NEXT FUNCTION)
15	TURN ON ADVANCE VALVE #1 SQX 20 CY
16	TURN ON INTENSIFY VALVE SQZ 10 CY
01	SQUEEZE 00 CYCLES
24	PREWELD 00 CY 30%I
02	COOL 10 CYCLES
20	WELD 10 CYCLES 50%I
03	HOLD 05 CYCLES
17	TURN OFF INTENSIFY/ADV VALVE #1
04	OFF 10 CYCLES

The example schedule shown above provides the following:

- The first function (#82) assigns the schedule to the proper stepper profile.

- The second function is used to prevent the control from executing a weld schedule while the gun is in the full retract position. If the gun is not in the partial retract position, the control will generate the RETRACT PILOT fault as a result of Function #80.)

NOTE: *Program the* RETRACT PILOT *fault as an* ALERT *condition in the setup parameters, so that the operator can place the valve in the partial retract position and re-initiate the weld schedule.*

If this condition is defined as a FAULT*, the control will require a fault reset before it can continue. (An exception is when the* Initiation On Fault *setup parameter is set to* ALLOW*, as described on page 5-10.)*

- If the weld schedule does NOT contain this function, the control lets you execute a sequence with the gun in the full retract position. If firing the control from full retract, the Extend Sqz From Retract (CY/2) setup parameter is added to the time the gun is closed under only hydraulic pressure.

NOTE: *These functions are enabled* ONLY *when setting the* Cylinder Type *setup parameter to* AIR-OVER-OIL*. The outputs controlling the Advance, Intensify and Blocking valves do* NOT *turn on when the air-only cylinders are selected.*

- The TURN ON ADVANCE VALVE function contains the time the gun will close under hydraulic pressure: (20 cycles in this example).

- The function TURN ON INTENSIFY VALVE contains the time the gun will close and build up pressure under air pressure: (10 cycles in our example).

- The next two functions define the weld and hold time.

- Finally, the control turns off the Advance and Intensify valves for the time set in the setup parameter Blocking Valve #n Delay (CY/2). When firing the control from the full retract position, the setup parameter Extend Sqz From Retract (CY/2) value is added to the value of Blocking Valve #n Delay. This allows the gun to return to the prior position.

Normally-Open (NO) Blocking Valve
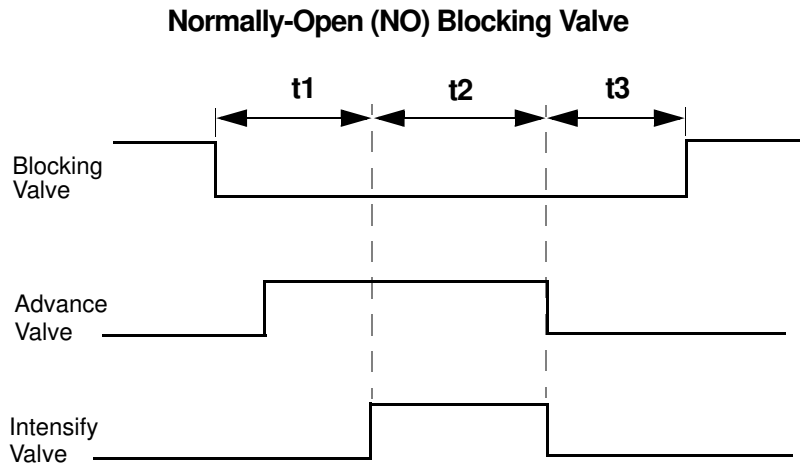
Where

T1 = time control closes gun under hydraulic pressure

If from *partial* retract:

programmed by TURN ON ADVANCE VALVE #n

If from *full* retract:

programmed by setup parameter Extend Sqz *plus* TURN ON ADVANCE VALVE function.

T2 = time control closes gun under air/welding pressure:

Programmed by functions TURN ON INTENSIFY VALVE *plus* WELD time *plus* HOLD time.

t3 = time control opens gun

If from *partial* retract:

Blocking Valve #n Delay setup parameter

If from *full* retract:

Blocking Valve #n Delay *plus* Extend Sqz setup parameters

Initiation From Retract

The processor also provides a function which you can place in a weld schedule to tell the control to check whether the selected cylinder is out of retract. The function (VERIFY CYLINDER #n IS OUT OF RETRACT) will abort the schedule and generate a Retract Pilot Fault if the cylinder is NOT in the partial retract position.

NOTE: *The* RETRACT PILOT *fault should be programmed as an* ALERT *condition in the setup parameters, so the operator can place the valve in the partial retract position and re-initiate the weld schedule.*

If this condition is defined as a FAULT, *the control will require a fault reset before it can continue. (An exception is when the* Initiation On Fault *setup parameter is set to* ALLOW, *as described on page 5-10.)*

If the weld schedule does NOT contain this function, the control will allow you to execute a sequence with the gun in the full retract position. When the control is fired from full retract, the Extend Sqz From Retract (CY/2) setup parameter is added to the time the gun is closed under only hydraulic pressure.

DEP-100S Programming Restrictions

Software version #T-96300-13 or greater has features that modify operation of the DEP-100S (Data Entry Panel). These include changes to the operation of the stepper, the ability to select No Weld operation and restrictions on inserting and deleting certain functions.

As described in the *DEP-100S Programming Guide*, the information you see will vary, based on the software contained in the weld processor. This section describes how the DEP operation varies from the standard.

Weld/No Weld Status

The DEP's Display Mode provides an option called **W/NW STATUS**. (Refer to Chapter 3 of the *DEP-100S Programming Guide*.) It allows changing the *software* setting at the weld processor from Weld to NoWeld.

This feature is NOT supported by this version of the MedWeld 4000 software. The Display Mode does not provide the W/NW STATUS option on its display.

Viewing Weld Data

Software supporting the MFDC displays data on the Weld Data screen on the DEP-100S (Hand-Held Terminal) differently from that for AC welding controls. This section describes the differences in the **Weld Data** screen:

```
 POWER ON                              COMM ON
 ..........................................
       busV secI    priI  hfc 0000    cf 000
 max   000  00000   0000  on time    dcv 000
 avg   000  00000   0000   0000        sch 00
 low   000  00000   0000   %I 00    WCU #00*
 ..........................................
 X    F1    XX    F2    XX    F3    XX    F4    X
```

max
avg
low

These three rows indicate the maximum, average and minimum values read during the last weld.

busV

This value is the INVERTER DC BUS voltage. The low can typically be as much as 100 VDC below the average. For diagnostic purposes, the AVG should be monitored. If average voltage keeps decreasing over time, this could point to the capacitors degrading and wearing out.

secl

This value represents the secondary current the inverter is firing. This value can be very low, as it indicates the current being delivered during the first MFDC half-cycle. It is during this half-cycle that the inductance of the transformer is overcome.

If setting the FIRING MODE: to (PRI CURRENT) or FIRING MODE: to (PRI VOLTAGE) in the setup parameters, the secondary current shown will be the primary current multiplied by the turns ratio set in the XFMR Turns Ratio setup parameter.

If setting the FIRING MODE: to (SEC CURRENT) in this setup parameter, the secondary current shown will be the actual secondary current read from the secondary current sensor.

pril

This shows the primary current the inverter is firing. This value can be very low, as it indicates the current being delivered during the first MFDC half-cycle. During this half-cycle, the inductance of the transformer is overcome.

Regardless of the setting in the Firing Mode setup parameter, the primary current shown will be the actual primary current read from the primary current sensor.

hfc The total number of MFDC half-cycles that were fired during the weld.

on time This value represents how long, in μsec, the inverter fired during the MFDC half-cycle to obtain the voltage or current required to make the weld. The maximum time in μsec the inverter can fire during a MFDC half-cycle is:

on time$_{max}$ = 1/(2$_*$f) − IGBTOFF

Where

f = the Operating High Frequency setup parameter value.

IGBTOFF = the minimum time required for an IGBT to turn off. This value is set at the factory.

This is a typical example:

on time$_{max}$ = 1/(2$_*$1,200) − 0.000010

on time$_{max}$ = 0.000416 − 0.000010

= 0.000406 sec.

Use this value to determine if the inverter can deliver more voltage or current if necessary. If the on-time is less than 406 μsec, the inverter can deliver more voltage or current. If the on-time is 406 μsec and more voltage or current is required, the application must be modified to use a transformer with a higher turns ratio, or a larger inverter.

%I The percent current provided during the last weld. This value results from dividing the actual current fired by the Maximum Current setup parameter.

cf C-Factor is 1% of the total available current. The C-Factor is re-calculated for each weld. It is the amount of the actual secondary current that will be added to the total weld energy for each 1% of current:

$$\frac{I_{sec}}{\%I} = \text{C-Factor}$$

This value is used to alert the maintenance staff of a welder's deteriorating secondary or shunting conditions.

dcv The DC buss voltage at the WCU. This is updated each time the DEP-100S polls the WCU.

sch #nn   The last schedule initiated by the selected WCU (schedule **nn**).

WCU #nn   The selected weld control (address **nn**).

Stepper Function

The primary change to the stepper operation is addition of the Tip Dress functionality.

However, this version of the software also inhibits the ability to turn the stepper on or off. (However, you *can* advance or reset the stepper. Refer to "Displays at the DEP-100S" on page 7-3.)

NOTE: *The SureWeld stepper is not available in controls equipped with the MFDC inverter.*

Fault Conditions 8

The fault conditions generated by the weld processor or MFDC inverter may not always identify the source of the problem. However, they do provide a starting point to begin searching.

Certain operating conditions are defined as Faults, Alerts, MAJOR, MINOR or NONE conditions in the setup parameters. However, the control's response to the conditions is standard:

When the control detects a fault condition you defined as MAJOR, it may inhibit welding or inhibit initiation of a new schedule until the fault condition is cleared. Alert or MINOR fault conditions serve more as a warning of a potential problem, or that maintenance may be required. If set to NONE, the control logs the fact that the condition occurred, but takes no action.

NOTES on MFDC Faults:

The MFDC inverter provides fault detection, and generates additional fault conditions. The inverter uploads fault conditions to the weld processor after each weld sequence. Refer to the ***MFDC Technical Reference Manual*** for descriptions of the inverter fault conditions and recovery procedures.

The FAULT RESET input will also reset fault conditions at the MFDC Inverter, with the exception of the CHARGE/DISCHARGE fault. You must cycle power to the inverter to reset this fault condition.

An inverter fault will activate the NO FAULT output at the weld processor, and the INVERTER READY TO WELD (IRTW) output. IRTW will inhibit the weld processor from sending a firing signal to the inverter.

The following tables list each fault described in this chapter in alphabetical order, with the page where the description appears:

AC Control Faults

MFDC Fault Status LEDs

Message	Explanation	Possible Cause	Remedy
Invalid Sequence Selected (See p. 5-2)	The combination of BINARY SELECT inputs was invalid.	The weld initiate was on but no BINARY SELECT inputs were active.	Turn on the BINARY SELECT input(s) required.
		The PARITY input failed to provide an *odd* number of inputs.	Check the number of BINARY SELECT inputs used to select the schedule number. If this is an *even* number, activate the PARITY input.
		Incorrect or loose wiring at the input module.	Check the wiring diagram for proper I/O designations. Verify that all wiring connections are secure.
		Incorrect or loose wiring at the input module.	Check the wiring diagram for proper I/O designations. Verify that all wiring connections are secure.
Weld Initiate Not Present (See p. 5-2)	The WELD INITIATE input was not active when checked by the control in Function #50.	Weld schedule contains Function #50, but the function is not required by the application.	Remove Function #50 from the weld schedule.
		The robot or ladder logic is not holding the INITIATE input high for the amount of time required by the application.	Repair robot or ladder logic program.

Message	Explanation	Possible Cause	Remedy
Control Stop (See p. 5-2)	The control detected that the CONTROL STOP input (normally HIGH) dropped out.	The CONTROL STOP input from the robot or program was not active when the control tried to initiate a weld.	Check/repair ladder logic. Note if the Control Stop message is both DIO and Serial I/O.
		The external or internal wiring (feeding CS1 and CS2) or the input module is open, causing a loss of input voltage to the input.	Check the wiring to verify that 24 VDC or 120 VAC is being provided to the CONTROL STOP input.
		The operator or ladder logic removed the CONTROL STOP input.	Check and correct the cause.
Stepper Approaching Maximum (See p. 5-2)	The linear stepper assigned to the schedule initiated has started the first weld in the last step.		The electrodes will soon need maintenance. Dress or replace the electrodes to avoid the END OF STEPPER fault condition.
	The stepper profile is programmed incorrectly.		Check the stepper profile.
End of Stepper (See p. 5-3)	A linear stepper in the group # assigned to the schedule initiated completed the last step in the profile.		Dress or replace the electrode tips. Reset the stepper.

Message	Explanation	Possible Cause	Remedy
High Current Limit (See p. 5-3) (Also **Secondary Current Limit** when the inverter is in Secondary Current firing mode)	The control detected that the current fired during the weld schedule exceeded the high current limit. (This could be the limit in the setup parameters OR set by Function #76 in the weld schedule.)	The limit is set too low.	Re-program high current limit (Function #76).
		Welder impedance is lower than it was when the current limit was set. The welder may be drawing more current than the originally-calculated maximum.	Check for improper installation of either a kickless cable or shunt cable.
		Pressure being maintained to the tips changed during the weld, so less pressure to the welding spot was provided. The weld processor will compensate, and possibly generate a HIGH CURRENT LIMIT fault.	With a pressure gauge, verify that constant pressure is being maintained. Check for things affecting pressure (such as hoses binding in the weld gun tooling, faulty or sticky solenoid valves or slow-moving cylinders.
		Incorrect measurement of the primary current. (Since both the weld processor and the firing card are involved in current measurement, certain failures on one of these cards may cause this fault to occur.)	Check for loose wiring at the J3 connector on the firing card.
			Secure the cable that runs between the firing card and the processor. Check for bad connector. Replace as necessary.
		Expulsion caused reduction in the weld resistance. (This may cause the current to exceed the calculated maximum.)	Adjust the schedule to reduce expulsion while maintaining sufficient current to provide a good weld.
Inhibit Initiation on Fault		The weld sequence was initiated with a fault present, but the weld schedule would not sequence due to a fault condition.	

Message	Explanation	Possible Cause	Remedy
Low Current Limit (See p. 5-3)	The current fired fell below the limit programmed, either in the setup parameters or Function #76 in a schedule.	Limit is set too high.	Reprogram the limit in Function #76.
		Unusual condition in the secondary.	Check the secondary. Look for dirty material, bad kickless cables or shunts, tip alignment, loose connections or reduced weld force due to hoses binding in the weld gun tooling, faulty or sticking solenoid valves or slow-moving cylinders.
		Incorrect measurement of the primary current. (Since both the weld processor and the firing card are involved in current measurement, certain failures on one of these cards may cause this fault to occur.)	Check for loose wiring at the J3 connector on the firing card.
			Secure the cable that runs between the firing card and the processor. Check for bad connector. Replace as necessary.
Control Failed to Fire	The MFDC inverter assembly failed to fire for a half-cycle.	Faulty firing cable. (The inverter did not receive the firing signal.)	Check the firing cable connector. Verify that it is secure.
		Inverter fault occurred during the weld, preventing it from firing for the half-cycle.	Review the inverter fault condition and act accordingly.
Extend Weld (See p. 5-5)	The control had to restart the weld schedule due to insufficient secondary current during a weld.	Low current limit is set too high.	Re-program the Low Current Limit setup parameter.
		Unusual condition in the secondary.	Check for improper part fit-up, dirty material, worn electrodes, bad kickless cables or shunts, or loose connections in the secondary circuit.
		Incorrect measurement of the primary current. (Both the weld processor and the firing card are involved in current measurement. A failure on one of these cards may cause this fault to occur.)	Check for loose wiring at the J3 connector on the firing card.
			Secure the cable that runs between the firing card and the processor. Check for bad connector. Replace as necessary.

Message	Explanation	Possible Cause	Remedy
Isolation Contactor Off When Needed (See p. 6-4)	Isolation contactor was not pulled in by the control when required by the weld schedule.	The instruction to activate the isolation contactor (Function #52) was missing from the weld schedule.	Verify that the schedule contains Function #52.
		The weld processor controls the isolation contactor, which is driven by a single solid-state relay. The weld processor signal is based on status of the CONTROL STOP and WELD/NO WELD Inputs. (Voltage must be present at these inputs to allow the weld processor to open or close the isolation contactor.)	Use the I/O Status display on the DEP-100S to verify that the inputs are HIGH (= 1) when required.
			Verify that the Ready to Weld signal was HIGH (= 1) when required.
		For externally-powered controls, an internal control transformer fuse is blown.	Check fuses and replace as necessary.
		The solid-state relay is faulty.	Replace relay.
		The instruction to activate the isolation contactor was executed, but the control was unable to pull in the contactor, due to incorrect or loose wiring to the output module.	Check the wiring diagram that came with your control for proper I/O designations. Verify that all wiring connections are secure.
		Faulty output module.	Replace module.
Inverter Main IC Off When Needed	Inverter charging pack did not pull in.	Input module on the regulator is defective.	Replace module.
		Pico fuse on the input module is defective or has blown.	Replace Pico fuse.

Message	Explanation	Possible Cause	Remedy
No Zero-Crossing Sync (See p. 5-5)	The control is unable to synchronize with the AC line voltage.	No incoming voltage to the control cabinet.	Verify incoming power to the control's circuit breaker with a volt meter. If no power, check for circuit break shunt trip or other errors.
		Failure of the incoming power signal to reach the firing card, (through its J3 connector) due to loose or faulty wiring.	Check for loose wiring at the J3 connector on the firing card. Repair as necessary.
		Zero-crossing signal is not reaching the weld processor card, due to loose cable or bad connector between the firing card and the weld processor card.	Secure the cable between the firing card and processor card. Check for bad connector, and replace as necessary.
		Faulty firing card.	Replace firing card.
		Faulty weld processor card.	Replace weld processor card.
		Overloading weld bus.	Re-distribute the weld bus load.
		Brown-out of power source.	Correct power delivery problem.
System Cooling (See p. 5-6)	TRANSFORMER OVER-TEMPERA-TURE input was not active when required by the control, or the SCR thermal switch was tripped.	Defective SCR thermostat.	Replace thermostat.
		Customer-supplied device did not activate the TRANS-FORMER OVER-TEMPERA-TURE input when required.	Check device.
		Loose/incorrect connections to input module or in circuit.	Check for proper wiring
		Insufficient water flow.	Check the water flow, access holes, hoses and filters (if used).
		Faulty input module.	Replace module.
Weld Interrupt (See p. 6-5)	The control entered No Weld mode while executing a weld schedule.	Robot or ladder logic de-activated the WELD/NO WELD Input.	Check robot or ladder to verify that the input is being held HIGH throughout the weld schedule. (Use the DEP I/O Status display to monitor the status of this input.) Also check the DEP I/O status.
		Incorrect or loose wiring to the input module.	Check for proper I/O designa-tions. Verify that all wiring connections are secure.
		Faulty input module.	Replace input module.

Message	Explanation	Possible Cause	Remedy
Control in No Weld (See p. 5-8)	The control moved from Weld Mode to No Weld Mode while executing a weld schedule.	Robot or ladder logic de-activated the WELD/NO WELD input.	Check robot or ladder to verify that the input is being held HIGH throughout the schedule. Use the DEP **I/O Status** display to observe the status of this input.
		Data entry device is pro-grammed in No Weld mode.	Verify that the data entry device is in Weld Mode.
		Loose or incorrect wiring to the input module.	Check for proper I/O designa-tions. Check to make sure all wiring connections are secure.
		Faulty input or output module.	Replace I/O module.
Inverter Serial Comm Error	The processor detected a loss of communications with the MFDC inverter over the MedLAN cable.	Faulty MedLAN cable and/or connectors.	Check the MedLAN cable to verify communications.
SCR Misfire (See p. 5-3)	The processor detected conduction on one half-cycle without conduction on the next half-cycle.	Faulty wiring. (For example, if the gate and cathode wires are swapped.)	Check all wiring connections. Verify that they are secure and correct.
		Insufficient squeeze time in the weld schedule. (Metal is expelled at the electrode/material interface.)	Program additional squeeze time in the selected schedule.
		Poor part fit-up or insufficient pressure. (Metal is being expelled at the faying surface.)	Try upsloping or inserting a preheat function (at a low % current) to try to form part fit-ups. Verify sufficient OFF time before the weld function in the weld schedule (typically 20 CY). Also try increasing weld pressure.
		Isolation contactor is dropping out early or coming in late.	Correct isolation contactor program or relay logic circuit.
		Faulty firing card.	Replace firing card.

Message	Explanation	Possible Cause	Remedy
Tips Not Touching or **Tips Touching** (See p. 5-3)	The electrode tips were detected as not being closed (or not being open) when expected.	Tips closing (or opening) too slowly, due to dirty or poorly lubricated cylinder or stuck tips.	Check for sticking gun cylinder. Remedy as required.
		Incorrect schedule timing.	Check robot or ladder logic schedule timing.
		Improper threshold programming.	Adjust threshold in setup parameters or functions.
		Faulty cylinder.	Replace or repair cylinder.
Slow Cylinder (See p. 5-4)	The cylinder exceeded the time allowed for closing.	Cylinder closing too slowly due to being dirty or poorly lubricated.	Check for sticking gun cylinder. Remedy as required.
		Faulty cylinder.	Replace or repair cylinder.
Initial Power Factor Out of Range (See p. 5-4)	The control executed a power factor test fire and the PF values were not within range.\n\nAlso check the schedule timing and part fitup. Verify that the correct valve is programmed in the weld schedule.	The inductance of the welding circuit was changed.	Check for any changes in the secondary loop.
		Incorrect measurement of power factor.	Make sure the current wires and voltage sense leads are secure, with the correct terminals of the firing card.
		Current coil resistor on firing card or load resistor on SCR assembly is not connected properly.	Confirm that resistor(s) are properly seated and connected.
		Power factor values programmed incorrectly.	Check the power factor settings.
Power Factor Limit (See p. 5-4)	The power factor detected while executing a weld schedule does not fall within the desired range.\n\nAlso check for poor part fitup, arcing and problems with factors such as the gun timing.	Any variation in the welding circuit inductance is reflected in the power factor.	Check for any changes in the secondary loop.
		Incorrect measurement of power factor.	Make sure the current wires and voltage sense leads are secure, with the correct terminals of the firing card.
		Power factor values are programmed incorrectly.	Check the power factor settings.

Message	Explanation	Possible Cause	Remedy
Voltage Compensation Limit (See p. 5-4)	The control could not fully compensate for a drop or surge in supply line voltage.	Check the nominal contactor voltage setup parameter.	Try recalculating the nominal contactor voltage setting.
		Too much load on the line when attempting the weld.	Check line voltage.
		Adjust tap settings on the weld transformer, and/or adjust weld heat away from extreme values.	Heat may be set at too high or low % current for the control to compensate for line voltage variations. Avoid programming values of 20 %I or secondary current that is too low.
		Steppers are pushing the total % current (programmed current + boost) over the threshold.	Adjust the stepper boost.
Insufficient Line Voltage (See p. 5-4)	The weld initiate was removed, or time expired while the control was waiting for the programmed line voltage in Function #72 or #73.	Overloading of the weld bus.	Re-distribute weld bus load.
		Brown-outs of the power source.	Measure bus voltage with no load. Ensure that it is providing the necessary voltage. (Confirm this by observing the low line voltage on the Weld Data display of the DEP.)

Message	Explanation	Possible Cause	Remedy
Isolation Contactor Off When Needed (See p. 5-5)	The isolation contactor was not pulled in by the control when required by the weld schedule.	The instruction to activate the isolation contactor (Function #52) was missing from the weld schedule.	Verify that the schedule contains Function #52.
		Isolation contactor is controlled by the weld control and driven by a solid-state relay. The weld processor signal is based on the status of the CONTROL STOP and WELD/NO WELD Inputs. (Voltage must be present at these inputs to allow the weld processor to open or close the isolation contactor.)	Use the **I/O Status** display on the DEP-100S to verify that the inputs are high (= 1) when required.
			Verify that the Ready to Weld signal is high (= 1) when required.
		For externally-powered controls, an internal control transformer fuse is blown.	Check fuses. Replace as necessary.
		The solid-state relay is faulty.	Replace solid-state relay.
		The instruction to activate the isolation contactor was executed, but the control was unable to pull in the contactor, due to incorrect or loose wiring to the output module.	Check the wiring diagram that came with your control for proper I/O designations. Verify that all wiring connections are secure.
		Faulty output module.	Replace module.
Low Battery (See p. 5-6)	The battery on the back of the processor card is low or discharged.		Replace battery/processor card. *(The battery is soldered in place. Only qualified personnel should attempt to replace the battery in an ESD-safe environment.)*
High C-Factor (See p. 5-6)	The C-factor read during the weld part of the schedule exceeded the value programmed in Function #97.	Unusual conditions in the secondary.	Check for causes of shunting or conducting water.
		The High C-factor limit was programmed too low.	Raise the high C-factor limit.

Message	Explanation	Possible Cause	Remedy
Low C-Factor (See p. 5-6)	The C-factor read during the weld part of the schedule fell below the value programmed in Function #97.	Unusual conditions in the secondary.	Check for worn cables, loose connections, low air pressure or other causes of decreased secondary current.
		The Low C-factor limit was programmed too high.	Lower the Low C-factor limit.
		Tips closing too slowly, due to a dirty or poorly-lubricated cylinder.	Check for sticking gun cylinder.
Heat Cycle Limit (See p. 5-6)	The control reached the programmed limit of consecutive weld cycles where conduction was detected.	Weld schedule programming was incorrect, or the heat cycle limit in the setup parameters was set too low.	Lower the number of cycles when the weld control is firing.
			Your application does not need the Heat Cycle Limit setup parameter. To disable this parameter, set it to 0.
		Faulty weld processor card.	Replace weld processor card.
Weld Interruption (See p. 5-6)	The control entered No Weld mode while executing a weld schedule.	Robot or ladder logic de-activated the WELD/NO WELD Input.	Check robot or ladder to verify that the input is being held HIGH throughout the weld schedule. (Use the DEP's I/O Status display to monitor the status of this input.)
		Incorrect or loose wiring to the input module.	Check for proper I/O designations. Verify that all wiring connections are secure.
		Faulty input module.	Replace input module.
I/O Update (See p. 5-7)	The weld processor detected a loss of communications for a specified amount of time while executing a weld schedule.	Bad connectors or improper seating of the weld processor in the chassis.	Remove power from the rack. Inspect the weld processor connections. Re-seat and restore power.
		Weld processor firmware and ladder logic are incompatible.	Verify compatibility. Correct as necessary.
Weld Proceed (See p. 5-7)	WELD PROCEED input did not become active when required by the control, or it was removed while the control was executing a schedule.	Faulty robot or ladder logic.	Check ladder logic to verify that the input is being activated.
		Loose or incorrect wiring to the input module.	Check for proper I/O designations. Check to make sure all wiring connections are secure.
		Faulty input module.	Replace input module.

Message	Explanation	Possible Cause	Remedy
Pressure Switch Error **(See page 5-7.)**	The PRESSURE SWITCH input was not active when required by the control, or it was removed while the control was executing a schedule.	Faulty robot or ladder logic.	Check ladder logic to verify that the input is being activated.
		Loose or incorrect wiring to the input module.	Check for proper I/O designations. Check to make sure all wiring connections are secure
		Faulty input module.	Replace input module.
Retract Pilot Error (See p. 5-8)	The retract cylinder was not out of retract when checked by the control.	Operator error.	The input was not activated when required by the operator.
		Either the Retract Mode or the Cylinder Type setup parameters were changed, and the control must be reset.	Cycle power to the control to reset it. *(*The control ignores changes to these settings until power is cycled.)
		Loose or incorrect wiring to the input module.	Check for proper I/O designations. Check to make sure all wiring connections are secure.
		Faulty input module.	Replace input module.
		Faulty weld processor card.	Replace weld processor.
Weld Current Shunting (See p. 5-8)	Back-feeding EMF is causing a voltage drop across the transformer, but no measurable current is flowing in the primary.	In a multi-gun configuration, guns from two different transformers or controls are touching or conducting through the work piece.	Check for touching weld guns. Remedy as necessary.
		Improper grounding of the welding tool.	Insure proper grounding of the transformer, fixture and control.
Isolation Contactor Not Enabled (See p. 5-8)	Isolation contactor was de-activated (opened) while the control was executing a weld schedule.	Faulty robot or ladder logic.	Check robot or ladder to verify that the input is being activated and held HIGH throughout the schedule.
		Loose or incorrect wiring to the input module.	Check for proper I/O designations. Check to make sure all wiring connections are secure.
		Faulty input module.	Replace module.

Modified: 9/17/08

MFDC Fault Status LEDs

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This section details the fault status LEDs on the MFDC inverter.

The following tables list each fault according to its LED label. One or more symptoms accompany each fault. Each symptom in turn lists its probable cause(s) and the recommended corrective action(s).

LED On Inverter	Symptom	Probable Cause	Corrective Action
INVERTER RTW	Does not light. (Check inverter fault LEDs and DEP-100S for faults. Initiate control if no faults are shown.)	Inverter not powered up.	Make sure main circuit breaker is on.
		Control initiation should generate a fault.	Troubleshoot fault generated.
		Inverter processor failure.	Replace inverter.
	DEP-100S displays NO ZERO CROSS-ING Fault. (Check line voltage on the WELD DATA screen on the DEP-100S display will likely be 0 VDC.)	Fuse blown in bus plug.	Replace fuse.
		Fuse blown in control.	Replace fuse.
		Mains voltage loses cycles. (Use Line Analyzer to check bus.)	Insure that all bus connections are tight. Insure that bus plugs are connected tightly to bus. Verify utilities.
		Circuit breaker is not turned on (Externally-powered controls only).	Turn on circuit breaker.
		Inverter interface cable is loose.	**MF600**: Remove power. Verify that both connectors at 4TB are properly seated. Remove power. Verify that both 16-position connectors are properly seated. **MF1200**: Verify that the 15-conductor cable between bridge rectifier and inverter SCR Firing Interface Connector on inverter are properly seated.
		Inverter processor failure.	Replace inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
HEARTBEAT (During normal operation, blinks once per second.)	Does not light.	24 VAC to inverter processor board is not present.	Verify that 24 VAC is present at J3 connector. Determine source of no voltage if 24 VAC is not present.
		24 VAC is present but no LEDs are lit.	Input Pico fuse(s) is/are open. Field repair may be possible: Contact WTC technical support for help.
		Inverter processor failure.	Replace inverter as necessary.
	LED blinks, goes off, comes on steadily and repeats.	Inverter processor failure.	Replace inverter as necessary.
INVERTER FIRING	Does not light.	Weld control is in No-Weld mode.	Place weld control in Weld mode. Check DEP-100S and switch settings.
		Weld function is not in weld sequence.	Add weld function to sequence.
		Weld function has 0 cycles programmed.	Program the number of cycles the weld needs to fire.
		Inverter did not fire.	Verify weld. Check DEP-100S for additional faults.
MEDLAN COMM	LEDs do not blink.	Bad connection between inverter and WTC processor.	Check that Belden cable (Blue Hose) from inverter to CI (Communications Interface) card connectors at both ends are properly seated. Cable should have continuity between connectors.
			Verify that Belden cable is wired with the Blue wire on pin 1 at both ends of cable.
			Replace DEP-100S cable from CI board to WTC Processor.
			Replace CI board.
			Replace WTC timer.
			Replace inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
INVERTER DUTY CYC. Fault	DEP-100S displays CHARGE/DIS-CHARGE DUTY CYCLE Fault.	Isolation contactor opens between welds, discharging inverter. Then control is initiated within 20 seconds.	Use the Isolation Contactor Delay setup parameter.
			Increase time in the Isolation Contactor Delay setup parameter.
			Decrease weld process cycle time.
			MF600 (without contactor in transformer primary): Consult WTC technical support for information on adding contactor in transformer primary.
HIGH CURRENT Fault	DEP-100S displays SECONDARY CURRENT fault.	The weld control is not receiving a signal from the secondary coil.	Check for signal being generated from the secondary current coil.
			Verify that cable from coil to inverter is not broken.
			Inverter input may be damaged: Replace inverter. **WORKAROUND:** Set the weld control in primary current control mode. Adjust weld current as required (generally slightly higher-magnetizing current required for primary winding).
	DEP-100S displays SOFT OVERCUR-RENT Fault/alert.	Inverter is firing current at the limit of what inverter can deliver. (Inverter factory setting.)	Decrease requested current for weld.
			Replace control with one with a larger current capacity inverter.
	DEP-100S displays WELDING TRANS-FORMER Fault.	Weld transformer second-ary diode failure. (Verify that diodes are shorted with an ohmmeter across gun tips. Remove one shunt cable to weld gun and verify that the weld gun is not shorted.	Repair gun if gun shorted.
			Replace weld transformer if gun is not shorted.

LED On Inverter	Symptom	Probable Cause	Corrective Action
ISO CNTR OFF Fault	DEP-100S displays INVERTER ISOLATION CONTACTOR OFF FAULT. (No Inverter Charging Request/Inverter Ready Request signal.)	Control transformer is not supplying voltage/current.	Replace transformer.
		Failure of output module on chassis.	Replace the output card.
		Control transformer fuse failure.	Replace fuses.
		Inverter input failure.	Replace inverter as necessary.
CURRENT REG Fault	DEP-100S displays CURRENT REGULATION FAULT. (The inverter cannot reach the target current.)	DEP-100S on-time is always at maximum. Target heat is too high.	Increase mains voltage up to 480 VAC.
			Reduce secondary impedance (Possibilities: Run shunts to gun installed closely together; Install shorter shunts if possible; Install larger shunts.)
			Increase weld transformer secondary voltage.
		Target current reached as inverter begins weld cycle. DEP-100S shows average current that is more than requested current. (Small secondary current requested.) Current does not decrease from higher to lower weld current because DC secondary current does not decay quickly enough.	Decrease weld transformer secondary voltage. Add a 1-cycle wait between welds; *or* Add a 1/2-cycle impulse function between welds.

LED On Inverter	Symptom	Probable Cause	Corrective Action
OVER TEMP Fault	DEP-100S displays INVERTER OVER-TEMPERATURE Fault.	An inverter thermal switch is open. (Switches installed on Inverter Status Interface pins 1 & 2, and 3 & 4.)	*Manifold hot:* Verify that water is flowing through the inverter.
			Manifold hot: Water flow rate is too low.
			Manifold hot: Water temperature is too high.
			Thermal switch failure: Replace inverter.
		Jumper on Inverter Status Interface, pins 5 and 6 is missing or damaged.	Replace jumper as necessary.
		Transformer thermal switch is open. (Refer to Inverter Status Interface in the *Inverter Technical Reference Manual* (WTC p/n #M-034045.)	*Transformer hot:* Verify that water is flowing through the transformer.
			Transformer hot: Water flow rate is too low.
			Transformer hot: Water temperature is too high.
			Transformer hot: Transformer duty cycle/current requested is too high.
			Thermal switch failure: Replace transformer.
		Inverter processor failure.	Replace inverter as necessary.
LINE-BUS Fault	DEP-100S displays LOW POWER LINE FAULT. Inverter could not provide sufficient voltage in Primary Voltage firing mode (similar to AVC fault in AC welder).	Mains voltage is too low for required weld.	Increase mains bus up to 480 VAC. This may require upgrading welding transformer.
		Mains voltage drops significantly during weld.	Correct mains voltage.
		On-time is at maximum.	Lower welding frequency (increases available on-time).
	DEP-100S displays INVERTER BUS FAULT. (The DC voltage dropped 40% during a weld.)	Mains voltage drops significantly during weld.	Correct mains voltage.
		Inverter processor failure.	Replace inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
GROUND Fault	DEP-100S displays OUTPUT GROUND FAULT.	Inverter cable connections have become loose.	Check all cabling to verify that connections are tight and no accidental grounding of cables is occurring. Check weld transformer primary cables, all cable connections in the control, the cabling to the line side of the weld control circuit breaker, the connections in the bus plug (including any junction boxes, if used) and the connection of the bus plug to the weld bus.
		Primary cable to weld transformer is defective. See Inverter Technical Reference manual, M-034045 for Primary Cable troubleshooting flowchart.	Replace cable as necessary.
		Weld transformer is defective. See *Inverter Technical Reference manual*, M-034045 for **Check Transformer** troubleshooting flowchart.	Primary shorted to ground: Replace transformer.
			Primary shorted to secondary: Replace transformer.
		The two coils used to check for ground fault are located on inverter outputs H1 and H2. Check the two cables, the current coil interface cables, that connect the inverter board to the coils. Check the cables for: Disconnection or unseating from the coil. (Ground fault occurs on every weld); *or*	Connect unseated cable to coil or to processor.
		Wires between coil and processor board are broken (usually during weld transformer primary cable installation to inverter. (Ground fault on every weld.)	WTC recommends replacing the inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
GROUND Fault (cont.)			Replace damaged current coil interface cable. NOTE: Replacing the current coil interface cable could slightly affect the inverter's calibration and make the primary current displayed by the control inaccurate. Preferably, re-calibrate the unit after repair. *or*:
			Field repair is possible. Repair a damaged cable by comparing to an undamaged cable; or contact WTC Technical support for connection information. NOTE: This field repair could slightly affect the inverter's calibration and make the primary current displayed by the control inaccurate. Preferably, re-calibrate the unit after repair.
		Defective sensors on inverter.	Replace inverter.
		Defective inverter processor	Replace inverter.
V_{dc} **BUS** Fault	DEP-100S displays DC BUS OVER VOLTAGE FAULT.	Over- voltage on plant mains.	Correct mains voltage.
			Defective substation transformer.
		Combination of ground faults.	Find and correct ground faults.
		Defective inverter processor	Replace inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
DRIVER Fault	DEP-100S displays HARD OVERCUR-RENT fault.	Shorted weld transformer primary.	Replace weld transformer.
		Shorted weld transformer primary cable.	Replace cable.
		Open weld transformer primary cable.	Replace cable.
		Missing mains line phase.	Replace blown fuse in bus plug.
		Shorted inverter transistor.	Replace inverter.
		Transistor driver failure.	Replace inverter.
		Failure of inverter snubber circuit.	Replace inverter.
		Bridge rectifier diode/ SCR failure.	Replace inverter.
	DEP-100S displays LOW VOLTAGE fault.	Inverter processor failure.	Replace inverter.

LED On Inverter	Symptom	Probable Cause	Corrective Action
CHARGE/ **DISCHARGE** Fault	DEP-100S displays CAPACITOR CHARGING fault.	Mains bus is not 240 VAC –20%.	Correct mains voltage.
		Inverter charging circuit failure.	Replace inverter.
		MF600: Broken or loose wiring between charging relay and 4TB.	Replace wire or tighten connections.
		MF600: 4TB connector is loose.	Turn off power and seat 4TB connectors.
		MF600: Charging relay failure (N.O. contacts have significant resistance, >2 ohms when closed).	Replace charging relay.
	MF600: Charging and main contactors do not pull in.	Source voltage is not supplied to inverter control interface connector (pins 1 and 3).	Verify that fuse is not blown.
			Verify that control transformer/ power supply is operational.
		Charging relay voltage is not present. (Check pin 4 with oscilloscope.)	Output relay on inverter processor failure: Replace inverter.
		Broken/loose wiring to charging relay coil; *or* Voltage on charging relay coil.	Replace wiring or tighten connections.
			Charging relay coil failure: Replace relay.
		Relay contacts are welded closed in discharge (normally-closed) position.	Replace charging relay.
	MF1200:	Inverter interface cable is loose.	Verify that 15-conductor cable between bridge rectifier and inverter SCR Firing Interface Connector on inverter are properly seated.
		SCR firing card on bridge rectifier is not firing all SCRs. (DEP-100S DC Voltage display is LOW.)	Replace SCR firing card.
		Bridge rectifier has a shorted phase.	Replace bridge rectifier.

LED On Inverter	Symptom	Probable Cause	Corrective Action
CHARGE/ DISCHARGE Fault (cont.)	DEP-100S displays CAPACITOR DISCHARGE fault.	Failure of inverter discharge resistor circuit.	Replace inverter as necessary.
		MF600: Failure of inverter processor.	Replace inverter as necessary.
		MF600: Discharge relay N.O. contacts are welded closed.	Replace discharge relay.
		MF600: Solid state relay for mains contactor (shorted) failure.	Replace solid state relay.

Hardware Troubleshooting 9

This chapter provides a quick look-up, to let you quickly isolate the cause of a problem, and corrective actions required.

Power Supply

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Symptom	Probable Cause	Corrective Action
Loss of power to the timer assembly	No 480/600 VAC power at the circuit breaker.	Check the bus feed to the control for 480/600 VAC present. Check for any disconnect on bus feed. Verify that the disconnect is <u>closed</u>.
	No 480/600 VAC power at the control transformer.	Check the control circuit breaker. Verify 480/600 VAC is present in incoming lines. Verify that operator handle is UP to turn ON the breaker.
	No 24 VDC/VAC at the timer assembly.	Check the fuse on the control transformer's secondary, to see if it is blown. Replace if necessary.
	Timer assembly is defective.	Verify that line power is connected to the power supply and to the timer assembly. If power is present but the timer assembly does not function, replace timer assembly.
	Blown fuse in timer assembly.	Check the fuse to see if it is blown. Replace if necessary.
	I/O point is shorted.	Inspect all I/O points for correct and secure connections. Correct and/or tighten any suspect connection(s).

Processor

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Symptom	Probable Cause	Corrective Action
Inadequate power or loss of power to the processor *(All LEDs are off)*	Line power is not connected to the power supply.	Verify that line power has been connected to the power supply.
		Check the jumper setting to verify that it matches the input voltage.
	Blown fuse on the power supply.	Check the fuse. Replace if blown.
	Power to the processor has been cycled too fast, causing a large current inrush resulting in a thermal overload.	Remove power to the processor for a minimum of two minutes. Then restore power.
	Defective power supply.	Monitor the line power to chassis power for possible transient or shorting.
		Replace power supply.
Processor not in Run Mode *(All processor LEDs are functioning normally)*	Improper mode selected.	Verify the processor mode selected. If in Program or Test mode, return to Run Mode.
	Line power out of range.	Check the jumper setting on the power supply. Verify that it matches the input voltage.
	Bad connectors or improper seating of the power connector. Defective processor, power supply or chassis.	Remove power. Inspect the power supply and processor connections.
		Remove power from the chassis and re-seat modules.
		Try the existing power supply in test chassis. If unsuccessful, replace the power supply.
Controller is inoperable, but no major CPU faults are detected	Defective I/O devices or I/O wiring.	Test inputs and outputs, according to the I/O Troubleshooting section.

Weld Processor

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Symptom	Probable Cause	Corrective Action
Inadequate or no power to the weld processor *(Power supply LED is on)*	Bad connectors or improper seating of power supply and/or weld processor in the chassis.	Remove power and inspect the power supply and weld processor connections.
		Remove power from the chassis and re-seat modules.
	Power has been cycled too fast, causing a large current inrush resulting in a thermal overload.	Remove power from the rack for AT LEAST two minutes. Then restore power.
	Blown fuse on the power supply.	Check the fuse. Replace if blown.
	Line power is not connected to the power supply.	Verify that line power is connected to the power supply.
	Improper voltage jumper setting.	Check the jumper setting to verify that it matches the input voltage.
Loss of RAM memory *(Batt LED is on)*	The battery on the weld processor card is low or dead.	Replace the battery on the weld processor card. *(The battery is soldered in place. Only qualified personnel should attempt battery replacement in an ESD-safe environment.)*
Weld processor cannot communicate *(CPU Fault LED on processor is on)*	Bad connectors or improper seating of the weld processor in the chassis.	Remove power. Inspect weld processor connections. Then cycle power.
		Remove power from the chassis, re-seat modules and restore power.
	Weld processor firmware and ladder logic are incompatible.	Verify compatibility; correct as needed. If not known, consult your WTC representative for assistance.

Symptom	Probable Cause	Corrective Action
Control and DEP-100S cannot communicate *(DEP and MedLAN LEDs may be off or blinking)*	Bad connection between weld processor and DEP-100S.	Check connection. Verify that it is secure.
		Check for bad/faulty connector and/or cable.
		Cycle power.
	If networking, no network power supply or no external 120 VAC source connected to the power supply.	Make sure you have a network power supply and that external 120 VAC is connected.
	Faulty DEP-100S, WTC processor or Network Power Pack.	Replace as necessary.
	Incorrect network address for weld control.	Verify the welder ID and network address of the device.
Communication over the MedLAN channel is inoperable. *(MedLAN LEDs may be off or blinking)*	Improper or loose MedLAN wiring.	Check for secure and correct wiring.
	Two or more controls have the same network address number.	Check MedLAN address of each control. Each control must have a UNIQUE address.
	Faulty WTC processor, faulty DEP-100S or faulty Network Power Pack.	Replace as necessary.

Solving Typical Problems

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This table describes some of the typical problems you may see in the field. The recommended procedure to troubleshoot each problem is provided.

Problem	Possible Cause	Possible Solution
Circuit breaker trips on power-up.	SHUNT TRIP output on the I/O is becoming active.	If NO, replace the output module.
		If YES, check the following: - Primary transformer cables grounded? - SCR breaking over at low potential, or shorted?
	Firing card is faulty.	Replace firing card.
	Inverter is faulty.	Replace inverter assembly.
	Circuit breaker is faulty.	Replace circuit breaker.
Circuit breaker trips while welding	The magnetic trip on the circuit breaker is set too low. (This causes the control to trip during the weld time of a schedule.)	Adjust the circuit breaker's magnetic trip threshold.
	The SCR is breaking over at low potential or shorted.	Replace SCR.
	SHUNT TRIP output on the I/O module is active when the SCR is not shorted.	Faulty firing card or I/O module. Replace as necessary.
	Faulty firing card.	Replace firing card.
	Intermittent ground.	Replace circuit breaker.

Problem	Possible Cause	Possible Solution
Control does not initiate a weld schedule.	Control is not receiving BINARY SELECT inputs.	Check the device supplying the inputs. Check the I/O module and check input supply voltage to the I/O module. Check the I/O Status Display at the DEP.
	The INITIATE WELD input is not being supplied with the BINARY SELECT inputs. (Certain applications require this.)	Check the device supplying the INITIATE WELD input. Check the I/O module and the input supply voltage to the I/O module. Check the I/O Status Display at the DEP.
	The PARITY input is required (to supply an ODD number of inputs. Certain applications require this input when the total number of inputs in the weld initiate is an even number.	Check the device supplying the PARITY input. Check the I/O module and the input supply voltage to the I/O module. Check the I/O Status Display at the DEP.
	Control is in retract, and the setup parameter specifies that initiation is INHIBITED from retract.	Check the setup parameters. Either take the control out of retract before initiating, or re-program the Initiation from Retract setup parameter. After changing the state of the retract setup parameters, you must also cycle power.
	Control has detected a fault condition. (Faults must be reset before initiating a schedule when the setup parameters INHIBIT initiation on faults.)	Check the DEP-100S to determine which fault condition was detected. Clear the fault(s) and re-initiate.
		Change the setup parameters to ALLOW initiation when fault conditions are active.
	Improper or loose wiring.	Verify that connections are correct and wiring is secure. I/O designations are listed in the drawing packet provided with the control. Also check input supply voltage to the I/O module.
	Faulty I/O module or weld processor.	Replace as necessary.

Problem	Possible Cause	Possible Solution
Control not responding to DEP-100S.	Bad connection between weld processor and DEP-100S.	Check the connection between the weld processor and DEP-100S.
		Check for faulty connector or cable.
	If networking, there is no network supply or external 120 VAC connected to the power supply (as required to power the DEP-100S).	Verify that the network power supply is connected and external 120 VAC is supplied.
	If networking, check for improper or loose wiring at MedLAN connection.	Check for secure and proper wiring. Refer to MedLAN wire designations described in "Providing MedLAN Connections" on page 2-6.
	Two controls share the same MedLAN address.	Check each control's address. Verify that each has a UNIQUE address.
	Verify that the DEP-100S software is compatible with the weld processor. (Consult your WTC representative for assistance.)	Update software.
	Faulty weld processor, DEP-100S or faulty Network Power Pack.	Replace as necessary.
Control sequences without firing SCR.	The control is in No Weld.	Check the status of the WELD/NO WELD input. Verify that the control and all data entry devices are in Weld mode.
	A fault occurred, causing the control to complete the weld schedule in No Weld.	Check the data entry device to determine any fault conditions. Clear the fault(s), correct the problem and re-initiate.
	Programming error.	Check the weld schedule being initiated to verify that the weld schedule contains a weld function. Also verify that the weld function has a value greater than zero for the specified number of cycles.
	Weld processor is not sending firing signals to the firing card. (Bad connection between weld processor and firing card.)	Remove power from the chassis and check for faulty connectors or cables. Re-seat modules and cycle power.
	Is the firing card receiving firing signals? (Is the Firing LED on the card on during the weld function?)	If **YES**, check the firing card and SCR wiring. Replace as necessary. Also check to see if firing into an open primary or secondary of the weld transformer. (Check the power factor settings.) If **NO**, check the weld processor card and replace as necessary.

Problem	Possible Cause	Possible Solution
	Is the inverter receiving firing signals?	If **YES**, check the firing card and SCR wiring. Replace as necessary. Also check to see if firing into an open primary or secondary of the weld transformer. If **NO**, check the weld processor card. Replace as necessary.
I/O not responding as expected.	Problem with the I/O.	Check the device supplying the input or receiving the output.
		Incorrect or loose wiring to the input or output module.
Isolation contactor not being pulled in	The weld schedule does not contain the function to activate the isolation contactor (Function #52).	Check the weld schedule to confirm that it contains Function #52.
	The isolation contactor is driven by a single solid-state relay (based on the status of the CONTROL STOP and WELD/NO WELD inputs). Voltage must be present at these inputs to allow the weld processor to open or close the isolation contactor.	Use the **I/O Status** display on the DEP-100S to verify that the inputs are HIGH (= 1).
	The solid-state relay is faulty.	Replace solid-state relay.
	If the control is externally-powered, one of the internal control transformer fuses may be blown.	Check fuses. Replace as necessary.
	The control was unable to pull in the isolation contactor due to incorrect or loose wiring to the output module.	Check the wiring diagram that came with your control for proper I/O designations. Make sure all connections are secure.
	Isolation contactor is not being held in between weld sequence.	Check the I/O point enabling the ISOLATION CONTACTOR SAVER Input.
		Check the setting of the Isolation Contactor Delay setup parameter.
	Faulty I/O module.	Replace I/O module.
No current reading (10 A. or less)	Did the control weld?	If **NO**, see *Control sequences without firing* on page 9-7. If **YES**, check for part fit-up, foreign material between electrodes and work piece, electrode pressure and tooling.
	Bad connection between current coil and firing card.	Check for proper and secure wiring connections between firing card and current coil.
	Faulty firing card.	Replace firing card.

Problem	Possible Cause	Possible Solution
No line voltage reading or no zero-crossing	Main breaker switch is OFF.	Turn ON the breaker.
	No 480/600 VAC is connected to the top of the breaker.	Verify that supply voltage (480 or 600 VAC) is connected to the top of the breaker. (On a single-pack control, supply voltage is connected at L1 and L2.)
	Faulty circuit breaker.	Supply voltage IS connected to the breaker. Verify that power is available on the load side of the circuit breaker.
	Faulty cable between firing and processor card.	Replace cable.
	If "No Zero Crossing Sync" occurs during a weld, there may be a loose connection or weak welding bus. (On the 1,200-A. inverter, the zero-crossing signal comes through the gate board on the SCR pack.)	Tighten loose connections. Install weld bus capacitors. Re-distribute loads on the weld bus. Install a stiffer power supply.
	Faulty firing card.	Replace firing card.
	Faulty weld processor.	Replace weld processor.

Application Note: Current Compensation

Scope
: This application note is intended for customers using single-phase, AC welding controls only. The door of your welding control will be labeled "AC" or "MFDC". This not does NOT apply to MFDC welding controls.

Current Compensation Information for AC Products

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Background Information
: In order to more accurately control the welding current, the MedWeld 4000 AC welding controls "learn" the characteristics of the welding transformer and the weld itself. The characteristics "learned" from previous welds are used to control the current in the weld which is now being made.

If for any reason, the welding current is not the proper value at any time during a weld, these "learned" characteristics allow the weld control to react very quickly and bring the welding current back to the correct value to avoid a bad weld. If something has changed on the welding machine between one weld and the next, the "learned" information might cause incorrect welding current for one or two welds after the change is made.

Changes to the welding machine that could cause momentary incorrect weld current values are:

1. Replacement or redressing of welding electrodes.

2. Replacement of secondary cables or flexible shunts.

3. Changing the welding transformer tap setting.

4. Maintenance or parts replacement on the welding gun

5. Changing the welding force (changing the air pressure on the welding gun)

For safety reasons, the welding controller should be powered down before any of the above changes are made. Once the operator verifies is powered down, make the change, and then turn the welding control back ON again.

If the electrodes are replaced or redressed, the weld stepper (if one is being used) must be reset. The action of resetting the stepper will alert the weld control that the "learned" data will not be valid.

Then, make two welds on a weld coupon or scrap part. Test the second weld (pull it apart) to be sure it is good. If necessary, readjust the weld current setting on the control and re-test to be sure a good weld is made. Once the operator achieves a good weld, they can resume production.

Application Note: Cascade Welding

Scope

This application note is intended for customers using a single AC weld control to fire multiple weld guns. The door of your welding control will be labeled "AC" or "MFDC". This not does NOT apply to MFDC welding controls.

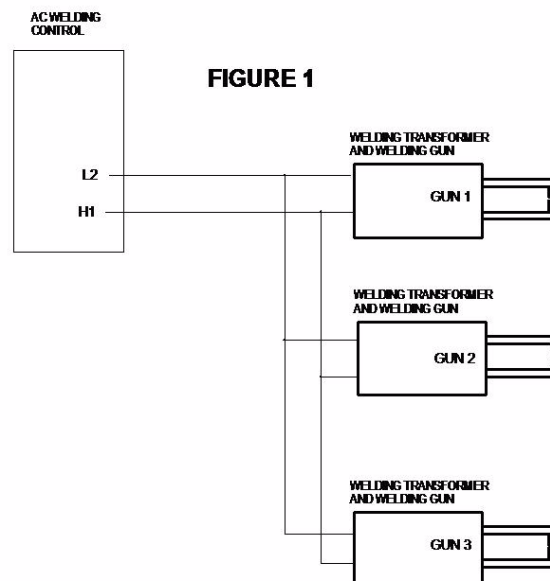## Cascade Welding Information for AC Products

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Background
Information

It is possible to operate more than one welding gun with a single weld control, if the welding guns are operated one at a time in succession. This is called cascade welding.

This application note gives some guidelines on setting-up and using cascade welding systems with a single-phase AC welding control.

Parallel Cascade
Method

There are two possible ways to do cascade welding. The first, and simplest method is to hook up (L2) to three welding transformers, each attached to a welding gun. Then connect the output (H) of a single AC welding control in parallel (See Figure 1).

Figure 1: A system with three transformers and three welding guns on a single control.

AC WELDING CONTROL

FIGURE 1

WELDING TRANSFORMER AND WELDING GUN

L2

H1

GUN 1

WELDING TRANSFORMER AND WELDING GUN

GUN 2

WELDING TRANSFORMER AND WELDING GUN

GUN 3

- To weld on gun #1: gun 1 must be closed and guns 2 and 3 must be left open.

- To weld on gun #2: gun 2 must be closed and guns 1 and 3 must be left open.

- To weld on gun #3: gun 3 must be closed and guns 1 and 2 must be left open.

When multiple welding transformers are connected in parallel to one welding control as shown in Figure 1, some additional rules should be followed:

1. No more than three weld transformers should be used.

2. The delayed firing option should always be turned ON in the setup parameters, regardless of what type transformers are used.

3. The control should be operated in primary constant-current mode ONLY! (Any other mode of operation is likely to cause intermittent circuit breaker trips and/or poor weld quality.)

4. Poly-pulse or pulsation welding should not be used.

Failure to follow these guidelines will result in diminished weld quality, sticking electrodes, increased downtime caused by intermittent circuit breaker trips and may void your warranty.

Multiple Output Cascade Method

Another example of cascade welding is to use a single weld control which has multiple outputs, one for each welding transformer (See Figure 2).

Figure 2: AC welding control with three outputs, connected to three welding transformers with three welding guns
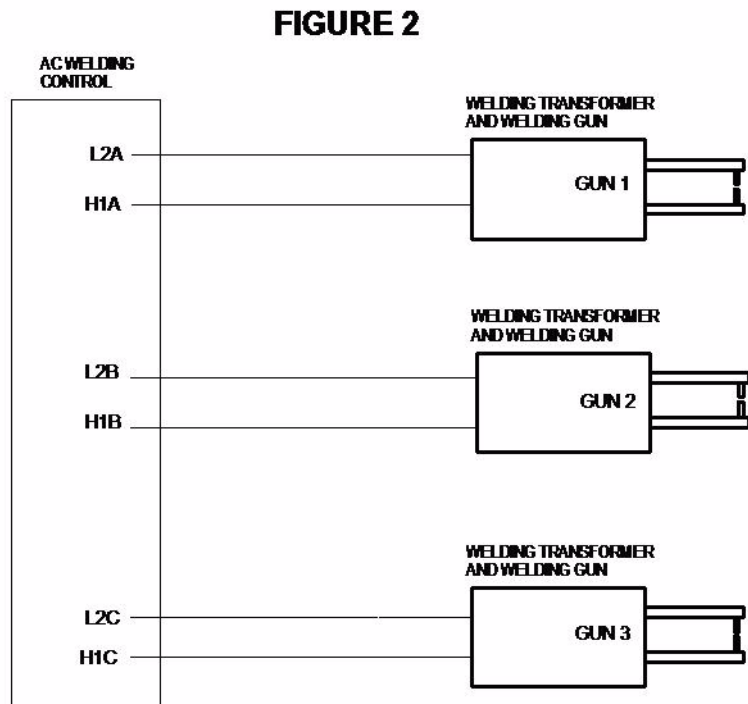
FIGURE 2

In this system, all three welding guns have the ability to be closed at the same time. However, the welding control applies current to the welding transformers in succession.

The Differences
Between Method 1
and 2

The cascade system in Figure 1 is the least expensive but it cannot make welds as quickly as the system in Figure 2 due to the extra time needed to allow each welding gun to open and close. The cascade system of Figure 1 is also limited, for practical reasons, to three welding guns or less. For these reasons, the system in Figure 2 is more common.

Weld Schedules in Cascade Welds

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When programming weld schedules for cascade welding, it is best to use a separate weld schedule for each weld. Separate weld schedules provide a greater degree of control and monitoring on each weld and generally make it easier to achieve good weld quality.

Production line conditions may not allow time for a separate weld schedule for each weld. It may become necessary to make two or more cascade welds within the same weld schedule. When multiple welds are made within the same weld schedule, all of the welds should be the same weld size, be in the same material/stackup, and should use the same size welding transformer and welding gun.