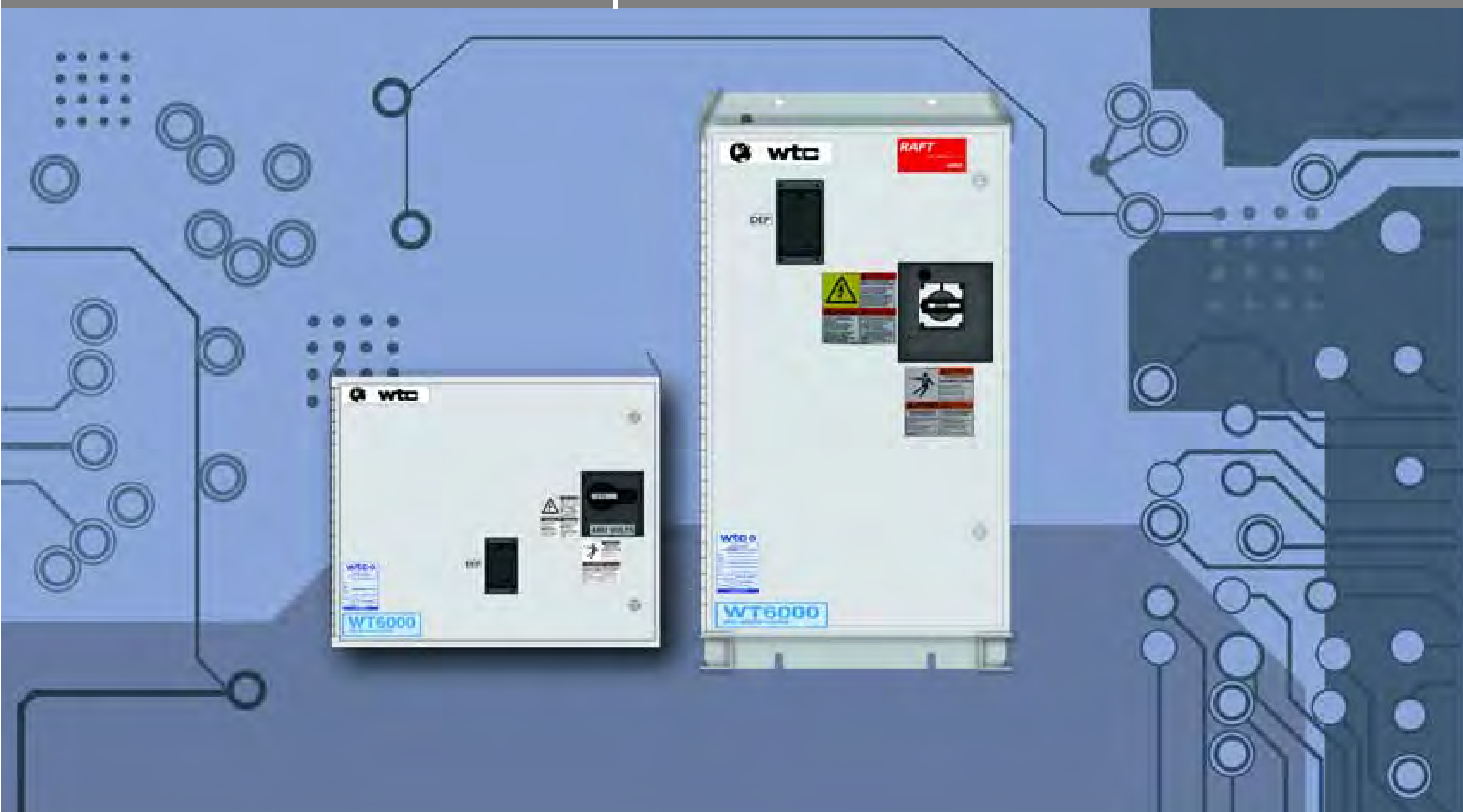
WELDING TECHNOLOGY CORP

Software # A15x50 | Manual # M-032501_V1.2



Revision No.:13
Modified: 12/ 16/ 2019

TABLE OF CONTENTS

TABLE OF CONTENTS

REGARDING THIS DOCUMENTATION

This documentation is written to support WTC Weld Control with timer software A15x50.

It has been designed for planning, programming, start-up personnel, operators, service technicians, plant operators, line builders and maintenance personnel to assist with procedures related to installing the weld control.

This instruction manual contains important information on the safe and appropriate assembly, transportation, commissioning, maintenance and simple trouble shooting of WTC Weld Control.

Some of the screen shots of the software application may appear different and are used for illustrative purpose only.

SOFTWARE UPDATES

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 latest updates by contacting your sales representative.

REVISION HISTORY

REVISION	REL. DATE	COMMENTS
V1.0	05/11/17	Initial release of Manual M-032501 to support timer software A15x50.
V1.1	8/8/18	Edits in description of stepper and tip dress function.
V1.2	12/16/19	Addition of information on ProfiNet and ProfiBus.

LANGUAGES AVAILABLE

This documentation was originally published in English.

SYMBOLS USED IN THIS DOCUMENTATION

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

THIS SYMBOL WILL BE USED WHEREVER FAILURE TO OBSERVE SAFETY MEASURES MAY RESULT IN DEATH, SEVERE BODILY INJURY OR SERIOUS DAMAGE TO PROPERTY.

THIS SYMBOL WILL BE USED WHEREVER INSUFFICIENT OR LACKING COMPLIANCE WITH INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

THIS SYMBOL DENOTES WHEN INSUFFICIENT OR LACKING COMPLIANCE WITH INSTRUCTIONS MAY DAMAGE EQUIPMENT OR FILES.

NOTE:

THIS SYMBOL INFORMS THE USER ABOUT SPECIAL FEATURES, OR WHERE TO FIND MORE INFORMATION.

THIS SYMBOL DRAWS ATTENTION TO SPECIFIC INSTRUCTIONS OR PRODUCT FEATURES.

THIS SYMBOL WILL BE USED TO NOTIFY THE OPERATOR WHEN AN OPERATION REQUIRES ESD SAFETY PRECAUTIONS TO BE FOLLOWED. FAILURE TO FOLLOW ESD PRECAUTIONS WHEN PERFORMING CERTAIN PROCEDURES MAY DAMAGE THE EQUIPMENT AND VOID THE WARRANTY

THIS SYMBOL INDICATES THAT ONLY WTC SERVICE PERSONNEL OR WTC REPAIR PARTNERS SHOULD SERVICE OR OPEN THIS DEVICE. BREAKING A WARRANTY SEAL WILL VOID THE WARRANTY OF THIS DEVICE

COMMON TECHNIQUES USED IN THIS MANUAL

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.

1. Numbered lists provide sequential steps or hierarchical information.

Italic type is used for emphasis.

WTC SUPPORT - INDUSTRIAL TECHNICAL SERVICES [ITS]

WTC tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. If you need assistance please contact Customer Support (see the table below); our trained technical specialists are available to help. When emailing please provide a photograph of the serial tag and Hardware Status Screen on the DEP 300s if possible.

If the product is not functioning and needs to be returned, contact your distributor. You must provide a Customer Support case number to your distributor in order to complete the return process.

Phone	United States/Canada	1.248.477.3900 Ext: 3020
Internet	Worldwide	Go to http://support.wtc.com

SAFETY INSTRUCTIONS

Safety Instructions call your attention specifically to danger potentials or risks. We distinguish among the following places where safety instructions may be required.

SAVE THESE INSTRUCTIONS.

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

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.

WHEN LIFTING ANY WEIGHT OVER 20 KG (~45 LB.), USE EITHER A TWO-MAN LIFT OR AN ASSISTED LIFT.

TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, CAREFULLY FOLLOW THESE INSTRUCTIONS.

ONLY QUALIFIED PERSONNEL ARE ALLOWED TO SERVICE THE WELD CABINET AND ASSOCIATED DEVICES!

MAKE CERTAIN THE CIRCUIT BREAKER HANDLE ON THE ENCLOSURE IS IN THE OFF POSITION BEFORE ATTEMPTING TO OPEN THE DOOR.

INSPECT THE ENCLOSURE FOR ANY POTENTIAL SHIPPING DAMAGE, LOOSE CONNECTIONS, OR PACKING MATERIALS INSIDE THE CABINET BEFORE OPERATION!

WTC DOES NOT RECOMMEND DRILLING ANY HOLES IN THE CABINET! IF ADDITIONAL HOLES ARE REQUIRED, MAKE CERTAIN ALL COMPONENTS ARE COVERED TO ADEQUATELY PROTECT FROM METAL DEBRIS. FAILURE TO FOLLOW THIS REQUIREMENT MAY LEAD TO A POSSIBLE EXPLOSION HAZARD AND VOID THE WARRANTY.

WARNING!

NEVER REMOVE CIRCUIT BOARDS OR ESTABLISH ELECTRICAL CONNECTIONS WITH POWER APPLIED! BE CERTAIN TO REMOVE POWER BEFORE SERVICING, INSTALLING OR REMOVING COMPONENTS.

WARNING!

CIRCUIT BOARDS OVER 24V SHOULD BE HANDLED WITH CARE AS THEY POSE A POTENTIAL SHOCK HAZARD TO THE OPERATOR.

VERIFY THE VOLTAGE TAPS ON THE CONTROL TRANSFORMER ARE SET CORRECTLY FOR YOUR PLANT LINE VOLTAGE PRIOR TO APPLYING POWER TO THE WELD CONTROL CABINET.

WARNING!

ALWAYS ENSURE PROPER FLOW RATE, TEMPERATURE AND CHEMISTRY OF COOLING WATER BEFORE OPERATION. OBSTRUCTED OR INSUFFICIENT FLOW OF COOLING WATER MAY DAMAGE COMPONENTS.

WARNING!

ADJUST THE MAGNETIC TRIP SETTING ON THE CIRCUIT BREAKER TO A VALUE APPROPRIATE FOR WELD OPERATION!

WARNING!

VERIFY ALL TRANSFORMER TAP VOLTAGES BEFORE ATTEMPTING TO APPLY POWER OR WELD. VERIFY THE SETUP PARAMETER “NOMINAL LINE VOLTAGE” TO YOUR FACILITY VOLTAGE IF THE OPERATOR EVER RELOADS SOFTWARE TO DEFAULT SETTINGS.

WARNING!

USE CU 75^{O} RATED CABLE ONLY.

WORKING WITH STATIC-SENSITIVE DEVICES

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.

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 b the traces or edge pad connectors.

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.

For detailed information about ESD contact: WTC Industrial Technical Services
Phone: +1 248-477-3900 | Fax: +1 248-477-8897
Email: service@weldtechcorp.com
Website: www.weldtechcorp.com

Chapter 1: SYSTEM DESCRIPTION

GEN6 WELD CONTROL

The WTC Gen6A Weld Control converts three-phase (50/60Hz) AC line voltage into a single-phase (1000HZ) AC square wave output. The square wave output is fed to the primary of a MFDC welding transformer, where it is rectified in the secondary to DC current. DC welding has many advantages over AC welding, including a more efficient consumption of plant power and the ability to make higher quality welds by having more control over the welding process.

NOTE: The enclosure configuration shown below is for illustration purposes only. Your cabinet configuration may differ depending on your specific application.

FEATURES

The weld timer module, internal to the weld control, uses free format programming and "Flexible I/O" to create weld parameters and programs to fit any welding application.

- Integrated Weld timer
- Up to 255 weld schedules.
- Spot to schedule assignment
- Built in Ethernet/IP.
- DeviceNet add-on available.
- ***RAFT™***/***SoftQ™*** Licensing
- 10 available linear current steppers, with 5 steps each.
- Internal web server allows the user to view and edit timer data from web browser, robot teach pendant or touch panel (HMI) device.
- Two weld firing modes: Percent of Available Volt-Seconds (%VS) and Constant Current (nnnn0 Amps).
- Non-battery backed up memory.
- Multi-language capability
- Air or water cooling

INSIDE THE WELD CONTROL

The WT6000 Weld Control contains the following sub-assemblies:

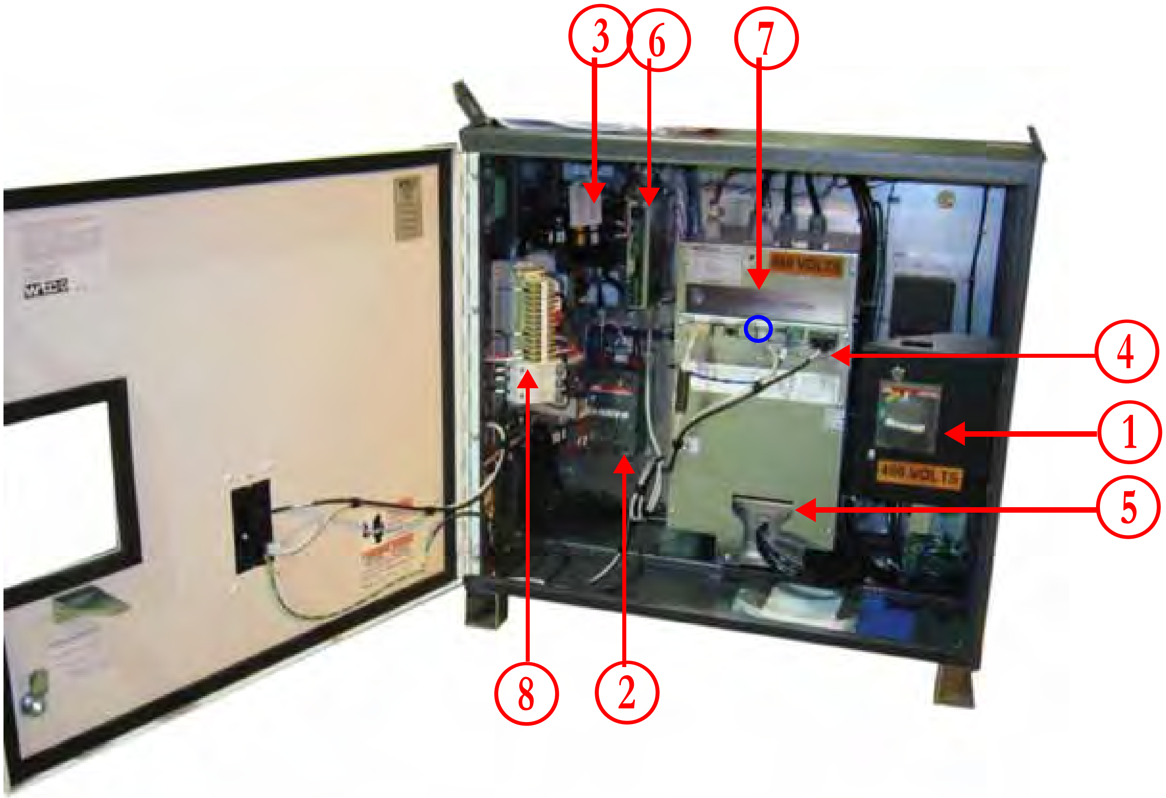
- **INVERTER ASSEMBLY:**
  Converts three-phase (50/60Hz) AC line voltage to single-phase (1000Hz) AC.
- **WELD TIMER ASSEMBLY (PROCESSOR):**
  Controls all communications, I/O, programming of weld schedules, setup parameters etc.
  It generates and interprets all hardware commands and feedback signals in the inverter, executes all weld schedule programs and generates fault/alert conditions as programmed.
- **ISOLATION CONTACTOR:**
  Located downstream of the inverter to interrupt voltage/current to the MFDC welding transformer.
- **CONTROL TRANSFORMER:**
  Steps down line voltage to 120V and 24V for the cabinet power.
- **CIRCUIT BREAKER:**
  Supplies or interrupts line voltage to the entire weld control cabinet.

LETHAL VOLTAGE MAYBE PRESENT IN THE INVERTER FOR SEVERAL MINUTES AFTER THE POWER SOURCE HAS BEEN REMOVED AT THE CIRCUIT BREAKER.

POWER MUST BE REMOVED FROM THE DC BUS BEFORE ASSUMING THAT IT IS SAFE TO SERVICE OR MAINTAIN THE WELD ENCLOSURE.

- **WATER/AIR MANIFOLD:**
  Water standard, optional air cooling available.

INTERIOR VIEW OF THE CONTROL



NO.	COMPONENT	DESCRIPTION
1	**CIRCUIT BREAKER**	Supplies or interrupts line voltage to the entire weld control cabinet.
2	**ISOLATION CONTACTOR**	Located downstream of the inverter to interrupt voltage/current to the MFDC welding transformer.
3	**CONTROL TRANSFORMER**	Steps down line voltage to 120V and 24V for the cabinet power.
4	**WELD PROCESSOR ASSEMBLY**	Brains of the weld control and controls all Ethernet/DeviceNet communications.
5	**INVERTER ASSEMBLY**	Converts three phase (50/60Hz) AC line voltage to single phase (1000Hz) AC output.
6	**CIOM MODULE**	Local serial interface to the weld processor. Has signal power distribution and controls local I/O
7	**CHARGE LED**	Glows red until the DC bus voltage is below 10 vdc on the DC bus. To ensure that the DC bus is completely discharged, measure between the positive and negative bus with a DC voltmeter set to the highest scale. CAUTION! When not lit do not trust that power is dissipated in the inverter until you have measured.
8	**TIP DRESS CIRCUIT**	Interface to control tip dress operation.

WELD CONTROL SPECIFICATIONS

POWER SOURCE	
STANDARD LINE VOLTAGE CONFIGURATION	3-Phase AC 220V-480V (± 10%)
ALTERNATE LINE VOLTAGE CONFIGURATION	3-Phase AC 575V (± 10%)
LINE FREQUENCY:	50 / 60 Hz (Automatic Selection)
OUTPUT FREQUENCY	1,000 Hz Default (Range = 400Hz-2,000Hz)*
STANDARD OUTPUT CURRENT CONFIGURATIONS AT 10% DUTY CYCLE	600 Amps Water (480 VAC) 400 Amps Water (600 VAC)
OUTPUT CURRENT OPTIONS AT 10% DUTY CYCLE	500 A Air-Cooled @ 480 VAC Line 350 A Air-Cooled @ 480 VAC Line 400 A Water-Cooled @ 480 VAC Line 1200 A Water-Cooled @ 480 VAC Line 600 A Water-Cooled @ 480 VAC Line 350 A Air-Cooled @600 VAC Line 400 A Water-Cooled @ 600 VAC Line 1000 A Water-Cooled @ 600 VAC Line 1800 A Water-Cooled @480 VAC/ 600 VAC Line
OUTPUT VOLTAGE OPTIONS @ 10% DUTY CYCLE	305 VAC Nominal @ 220 VAC Line 525 VAC Nominal @ 380 VAC Line 650 VAC Nominal @ 480 VAC Line 800 VAC Nominal @ 575 VAC Line
OUTPUT VOLTAGE OPTIONS @ 5% DUTY CYCLE	900 A Water-Cooled @ 480 VAC Line 1800 A Water-Cooled @ 480 VAC Line
OUTPUT VOLTAGE OPTIONS @ 3% DUTY CYCLE	900 A Water-Cooled @ 480 VAC Line
OUTPUT VOLTAGE OPTIONS @ 2% DUTY CYCLE	900 A Water-Cooled @ 600 VAC Line
MAXIMUM POWER	260 KVA @ 480 VAC Line Power
DEVICE TYPE	IGBT
POWER CONSUMPTION	70 VA (idling condition)

*This feature is not available in all software. Contact your WTC sales associate for details.

PROCESSOR & FUNCTIONS	
WELD PROCESSOR	Series 6000
STANDARD COMMUNICATIONS	Ethernet IP 10/100 BaseT 1MB SSPI (Smart Serial Peripheral interface) RS485
OPTIONAL COMMUNICATIONS	DeviceNet, ProfiNet, ProfiBus
NUMBER OF WELD SCHEDULES	255
NUMBER OF STEPPERS	10
PROCESSOR STORAGE TYPE	F-RAM (No Battery Required)
WELD PROCESSOR LANGUAGES	English French Spanish

ENVIRONMENTAL CONDITIONS	
OPERATING TEMPERATURE	+5° C to +50° C
HUMIDITY	0 - 90% (Relative, without Condensation)
ESD	EN 61000-4-2 Level 3
NOISE IMMUNITY	EN 61000-4-4 Level 3
SURGE IMMUNITY	EN 61000-4-5 Level 3

WATER COOLING REQUIREMENTS	
• Maximum temperature not to exceed 104° F. (40° C.), or fall below the dew point of ambient air at about 70° F. (21° C.) • pH maintained between 7.0 and 8.0 • Maximum chloride content 20 PPM (parts per million) • Maximum nitrate content 10 PPM • Maximum sulfate content 100 PPM • Maximum suspended solids content 100 PPM (non-abrasive) • Maximum total solids content 250 PPM (suspended and dissolved) • Maximum calcium carbonate content 250 PPM	
MINIMUM WATER FLOW RATE	Greater than 5 liters/min (1.32 gal/min)
MAX PRESSURE DROP @ 5 LITERS/MIN FLOW	Less than 70 kPa / .7 bar / 10 PSI
PRESSURE RATING	Less than 620 kPa / 6.2 bar / 90 PSI
ELECTRICAL RESISTIVITY OF WATER	Greater than 5000 ohms/cm
WATER INLET TEMPERATURE	Less than 95° F (35° C)

AIR COOLING REQUIREMENTS	
AMBIENT AIR TEMPERATURE	Less than 104° F (40° C)
MINIMUM FAN RATING	80 CFM
AIR MOUNTING LOCATION	Minimum 76mm (3 inches) from wall or object

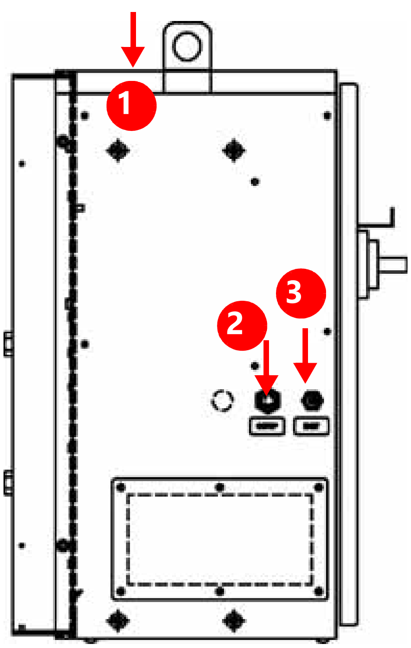
STORAGE & TRANSPORTATION	
STORAGE	- 25°C - + 70° C
TRANSPORTATION	- 25°C - + 70° C
Note: Make sure the cooling system is fully drained prior to storage since there maybe a possibility of leakage in the heat sink and contamination of the cooling agent.	

Chapter 2: INSTALLING THE CONTROL

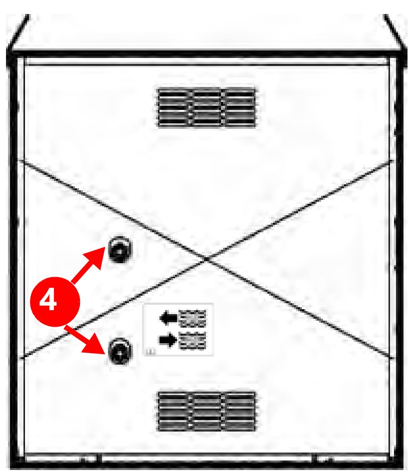
To install the WTC weld control, you must provide the required EtherNet /DeviceNet communications, configure the unit for the network, set the network address and program the weld timer to meet your application requirements.

STANDARD CONNECTIONS

1. 3-Phase AC Line Power
2. Control Stop
3. (ENET1) Plant Ethernet
4. Cooling Water IN / OUT Connections

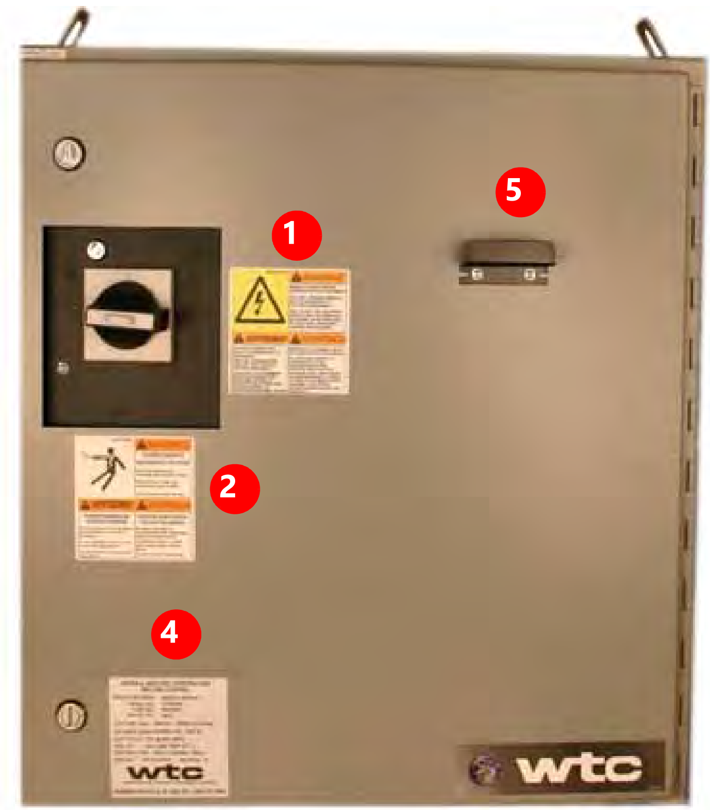


Side View



Rear View

ENCLOSURE SAFETY LABELING



NOTE: For illustrative purpose only. Customer specific connections may vary.

1	**WARNING!** Arc Flash and power safety
2	**WARNING!** Stored energy device
3	Alternate location for Fanuc pendant
4	Serial Tag

INSTALLATION CHECKLIST

USE THE FOLLOWING CHECKLIST AS A GUIDE DURING THE INSTALLATION PROCESS. IF YOU ARE UNSURE HOW TO PROPERLY INSTALL AND HOOKUP THE WELD CONTROL CABINET, CONTACT WTC FOR ASSISTANCE.

1. Ensure electricity is locked out at welding bus, power distribution panel, or other applicable power source.
2. Verify weld control cabinet circuit breaker is in the OFF position.
3. Inspect interior of weld control cabinet for loose and/or missing parts. Inspect for any shipping damage.
4. Check and ensure all water drain holes are open and unblocked.
5. Mount weld control at desired location using appropriate mounting hardware.
6. Remove access plates and drill / punch holes for:
   - Three-phase AC line power and ground.
   - Output power to MFDC welding transformer and ground.
   - I/ O connections (if applicable).
7. Plumb cooling water to supply and return fittings.
8. Connect 3-phase AC line power cables (L1, L2, L3) to top of circuit breaker (line side) and tighten according to manufacturer specifications.
9. Connect plant ground cable to copper grounding post inside cabinet.
10. Connect power cables from output of weld control (H1, H2) to primary of welding transformer.
11. Connect ground cable from copper grounding post inside cabinet to welding transformer.
12. Connect data entry panel, Control Stop (CSTOP) and EtherNet (ENET1) cables.
13. Wire I/O connections.
14. Verify magnetic and thermal trip settings on circuit breaker, per manufacturer specifications (if applicable).
15. Inspect cabinet and verify all wiring connections (high voltage, terminals, crimp connections, etc.) are secure.
16. Close weld control cabinet door and lock with 1/4-turn fasteners.
17. Remove electrical lock out devices.
18. Turn weld control cabinet circuit breaker ON.
19. Ensure cooling water is flowing at specified flow rate.

20. Use data entry panel or network software application to program I/O parameters for Device Net, Ethernet/IP or specialty communication modules.
21. Use data entry panel or network software application to program setup parameters, weld schedules and current steppers as required for customer application.

WATER COOLING REQUIREMENTS

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

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 21° C below the temperature of the surrounding air - condensation may occur and damage components.

[For Water cooling details refer to Water Cooling table on Page "Water Cooling Requirements" on page 13].

Caution:

FAILURE TO MAINTAIN PROPER WATER COOLING TO THE WELD CONTROL CABINET MAY CAUSE DAMAGE TO THE WELD CONTROL AND VOID THE WARRANTY. CONTACT WTC IF YOU HAVE ANY QUESTIONS REGARDING THE WATER COOLING REQUIREMENTS LISTED ABOVE.

COOLING WATER HOOK-UP

Connect the cooling water and test for leaks BEFORE doing any wiring into the control. It is ***essential*** to take this precaution, to reduce the risk of electrical shock.

FLOW RATE

The inverter requires a water flow rate of 5 liters (about 1.32 gallons) per minute for proper cooling. If using a water flow switch that is monitored by the weld control, install the flow switch in the water exit lines. Set this switch to trip at 5 liters (1.32 gallons) per minute. Wire the flow switch contacts to the machine control to cause the machine to stop if water flow is insufficient.

WATER PRESSURE

The minimum required water pressure to assure proper water flow is .7 bar (10 PSi).

NOTE:

IF USING A RECIRCULATING WATER SYSTEM, THE PRESSURE DROP IN THE WATER RETURN LINE MUST BE ADDED TO THE MINIMUM REQUIRED PRESSURE.

THE MAXIMUM ALLOWABLE PRESSURE IS 6.2 BAR (90 PSI). PRESSURES ABOVE THIS LIMIT WILL DAMAGE HOSES AND CAUSE LEAKS.

Caution:

FAILURE TO MAINTAIN PROPER WATER COOLING TO THE WELD CONTROL CABINET MAY CAUSE DAMAGE TO THE WELD CONTROL AND VOID THE WARRANTY. CONTACT WTC IF YOU HAVE ANY QUESTIONS REGARDING THE WATER COOLING REQUIREMENTS LISTED ABOVE.

Caution:

THE INVERTER ASSEMBLY CONTAINS COMPONENTS THAT ARE SENSITIVE TO ELECTROSTATIC DISCHARGE (ESD). THE SYSTEM INTEGRATOR MUST TAKE ALL REQUIRED STEPS TO PROTECT THE EQUIPMENT FROM ESD, TO PREVENT DAMAGE TO ESD-SENSITIVE COMPONENTS.

CABLE ROUTING GUIDELINES

WTC has exercised due care in designing the MFDC inverter to minimize its susceptibility to electronic noise interference. However, routing of cables within the cabinet can either impair or improve overall performance.

Installation involves four types of wiring:

- ***Power wiring*** is all wiring carrying the weld current or 110 VAC and above.
- ***High-voltage I/O wiring*** carries all i/O used to pull in valves, relays and contactors.
- ***Low-voltage I/O wiring*** is discrete, used to communicate status information. This category also includes the 24 VDC inverter supply and the firing signal from the timer.
- Communications wiring connects equipment to the EtherNet network. WTC uses RJ–45, for 5v signal levels.

All four sets of these cables are discrete. Be sure to physically separate them by several cm. If any two sets of discrete cables must run in parallel, you MUST place a grounded ferrous shield between them. If any discrete sets of cables must cross, they must cross at right angles.

WARNING!

TO PREVENT DATA DEGRADATION DUE TO ELECTRICAL NOISE, BE CERTAIN TO KEEP SIGNAL COMMUNICATIONS WIRING SEPARATE FROM POWER WIRING AT ALL TIMES! SIGNAL WIRING SHOULD NOT USE THE SAME ACCESS PLATES, CONDUITS, WIRE BUNDLES OR CABLE TRAYS AS HIGH-VOLTAGE POWER WIRING.

CABINET MOUNTING AND FASTENING

The weld control units dimensions vary, based on its size. Refer to the installation drawings provided with your control for the exact dimensions and mounting tolerances.

WTC recommends leaving a clearance of AT LEAST 3 inches (about 76mm) from the wall. This clearance is necessary to allow access for the cooling water hoses and power line outputs.

The control enclosure has four mounting tabs: Two at the top of the cabinet and two at the bottom. Because it is heavy, the cabinet must be mounted to a strong structure such as a machine frame.

Make certain to mount the cabinet using ***all four*** mounting tabs.

Caution:

WTC DOES NOT RECOMMEND DRILLING ADDITIONAL HOLES INTHE SIDES OR TOP OF THE CABINET FOR ADDITIONAL BRACKETS.

IF IT IS NECESSARY TO CUT HOLES IN THE ENCLOSURE, GREAT CARE SHOULD BE TAKEN TO PREVENT METAL SHAVINGS FROM FALLING ONTO ANY ELECTRONIC COMPONENTS. WTC'S WARRANTY DOES NOT COVER DAMAGE DUE TO METAL DEBRIS

Caution:

IT IS IMPORTANT THAT THE WELD CONTROL IS MOUNTED ON A LEVEL SURFACE. IF THE WELD CONTROL IS MOUNTED ON AN UNEVEN SURFACE, THE CABINET DOORS MAY BE DIFFICULT TO OPEN. FAILURE TO USE APPROVED MOUNTING HARDWARE MAY VOID YOUR WARRANTY.

Caution:

THE ENCLOSURE SHOULD BE SECURELY MOUNTED ONTO A FIXED STRUCTURE, FOR EXAMPLE: FLOOR, STAND OR ROBOT.

Caution:

THE ELECTRICAL INSTALLATION FOR THE WELD CONTROL SHOULD MEET ALL NATIONAL AND LOCAL ELECTRICAL CODES AS DETERMINED BY THE AUTHORITY HAVING JURISDICTION.

ELECTRICAL INSTALLATION

PRIOR TO MAKING ANY CONNECTION INSIDE THE WELD CONTROL CABINET:

Danger!

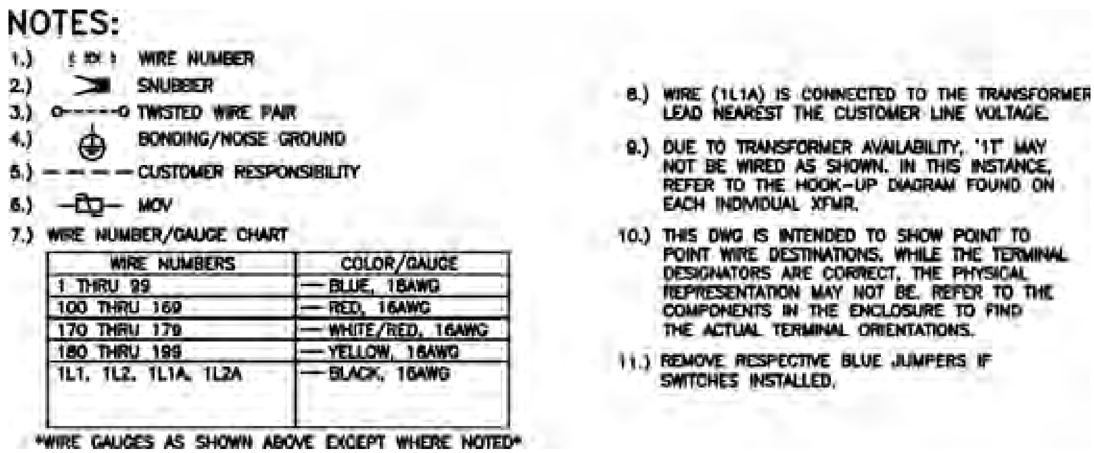
REFER TO YOUR FACILITIES ELECTRICAL LOCKOUT POLICY AND PROCEDURES.

Danger!

VERIFY NO HIGH VOLTAGE IS PRESENT INSIDE THE CABINET WITH A MULTIMETER.

Danger!

THE DOOR OF THE WELD CONTROL CABINET IS INTERLOCKED WITH THE CIRCUIT BREAKER TO PREVENT THE DOOR FROM BEING OPENED WHILE POWER IS ON. NEVER ATTEMPT TO DEFEAT THIS SAFETY MECHANISM.



NOTES:

1.) WIRE NUMBER
2.) SNUBBER
3.) TWISTED WIRE PAIR
4.) BONDING/NOISE GROUND
5.) CUSTOMER RESPONSIBILITY
6.) MOV
7.) WIRE NUMBER/GAUGE CHART

WIRE NUMBERS	COLOR/GAUGE
1 THRU 99	— BLUE, 18AWG
100 THRU 169	— RED, 16AWG
170 THRU 179	— WHITE/RED, 16AWG
180 THRU 199	— YELLOW, 16AWG
1L1, 1L2, 1L1A, 1L2A	— BLACK, 16AWG

WIRE GAUGES AS SHOWN ABOVE EXCEPT WHERE NOTED

8.) WIRE (1L1A) IS CONNECTED TO THE TRANSFORMER LEAD NEAREST THE CUSTOMER LINE VOLTAGE.

9.) DUE TO TRANSFORMER AVAILABILITY, '1T' MAY NOT BE WIRED AS SHOWN. IN THIS INSTANCE, REFER TO THE HOOK-UP DIAGRAM FOUND ON EACH INDIVIDUAL XFMR.

10.) THIS DWG IS INTENDED TO SHOW POINT TO POINT WIRE DESTINATIONS. WHILE THE TERMINAL DESIGNATORS ARE CORRECT, THE PHYSICAL REPRESENTATION MAY NOT BE. REFER TO THE COMPONENTS IN THE ENCLOSURE TO FIND THE ACTUAL TERMINAL ORIENTATIONS.

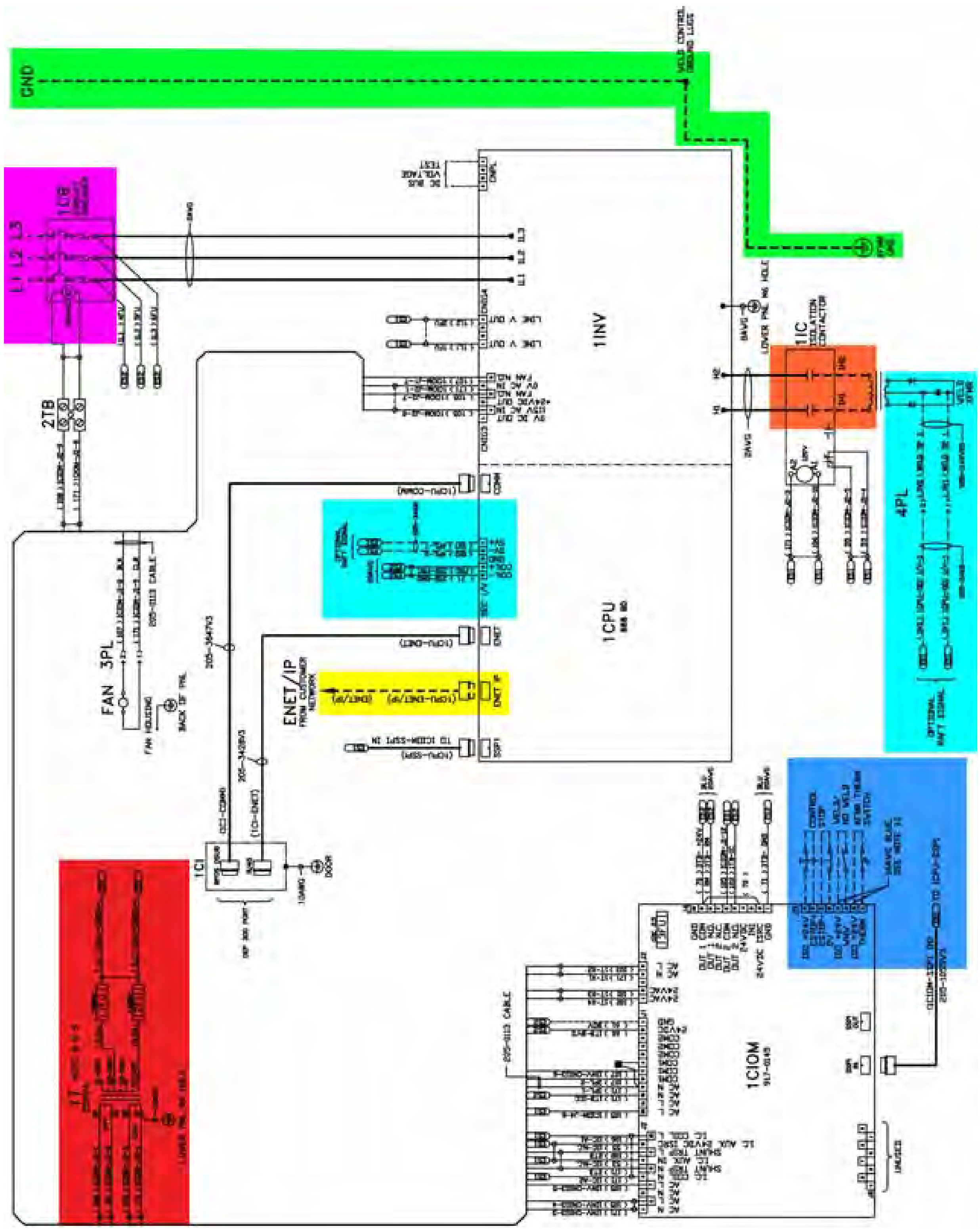
11.) REMOVE RESPECTIVE BLUE JUMPERS IF SWITCHES INSTALLED.

WIRING DIAGRAM INDEX:

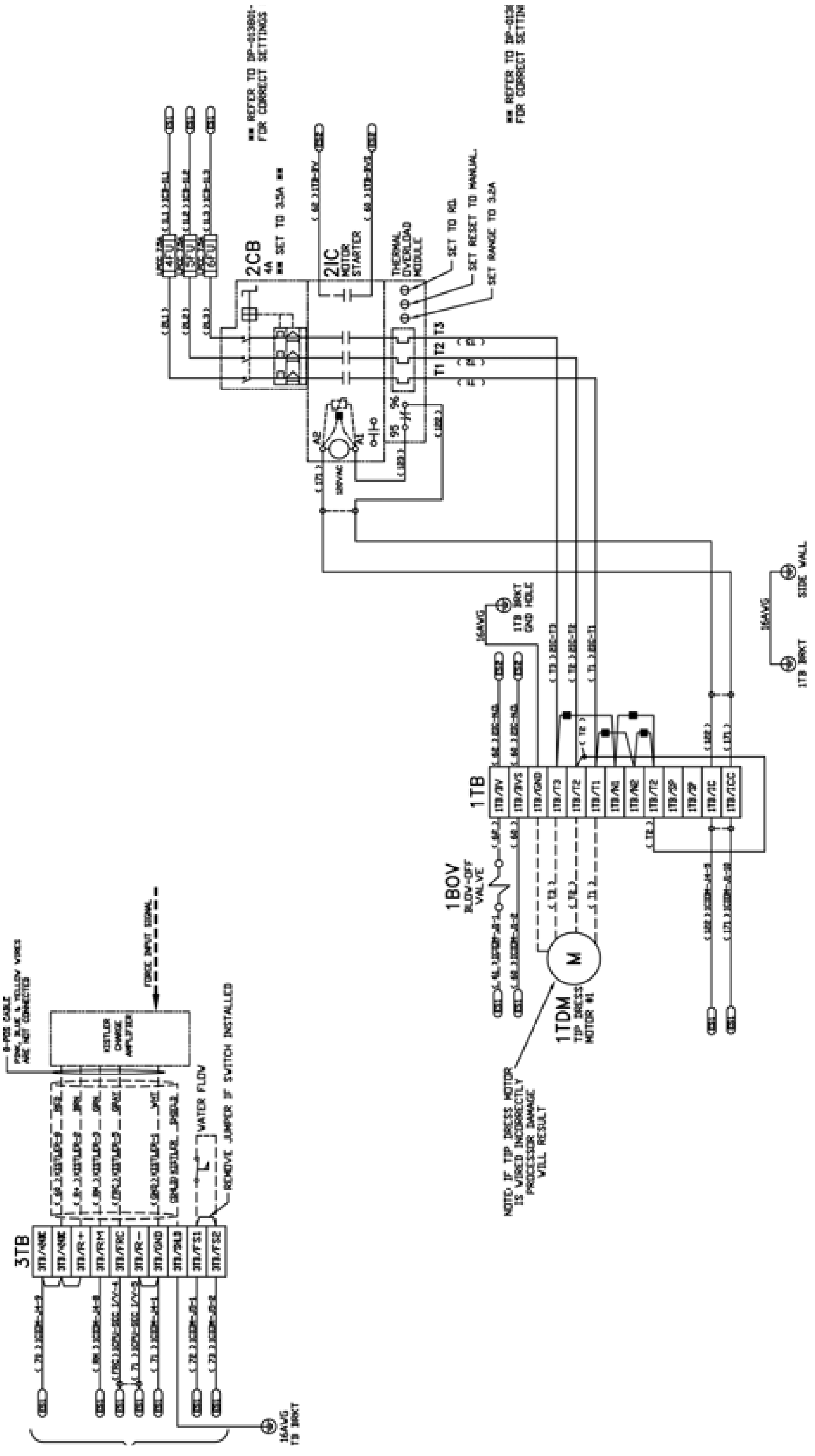
STEP	COLOR	DESCRIPTION
78 75		Verify the primary of 1T control transformer is correctly tapped for the plant line voltage.
79 75		Connect plant line voltage to L1, L2, L3 terminals on 1CB circuit breaker.
80 75		Connect ground cable from plant ground to weld enclosure copper ground lug.
4.		Connect EtherNet cable from plant network to ENET1 connector.
59 75		Connect Control Stop cable from plant network to C-Stop connector.
60 75		Connect voltage sense cable from welding transformer to ***RAFT***™ connector.
61 75		Connect weld transformer cables to 1H1 and 1H2 terminals on 1IC isolation Contactor.

NOTE: For illustration purposes only. Your cabinet configuration may differ depending on your specific application. For specific electrical drawings, contact WTC.

CONTROL WIRING



TIP DRESS CIRCUIT WIRING



WELD CONTROL PROGRAMMING AND SETUP

Before welding can begin, the following parameters need to be programmed into the weld timer.

PROGRAM SETUP PARAMETERS

Review and program the Setup Parameters as required for the welding application.

The Review Setups Menu is found in the DEP-300s by pressing:
Program Mode (F2) -> Review Setups (F4).

NOTE:

REFER TO "Chapter 6: FAULTS AND SETUP PARAMETERS" ON PAGE 102 FOR DETAILED INFORMATION REGARDING THE DESCRIPTION AND PROGRAMMING OF SETUP PARAMETERS.

PROGRAM WELD SCHEDULES

Review and program the Weld Schedules as required for the welding application.

The Review Schedule Menu is found in the DEP-300s by pressing:
Program Mode (F2) -> Review Schedule (F2).

NOTE:

REFER TO "Chapter 4: WELD SCHEDULE FUNCTIONS" ON PAGE 45 FOR DETAILED INFORMATION REGARDING FUNCTION DESCRIPTIONS AND THE PROGRAMMING OF WELD SCHEDULES.

SETUP LINEAR CURRENT STEPPER FUNCTIONS

Review and program the Linear Current Stepper Functions as required for the welding application.

The Review Stepper screen is found in the DEP-300s by pressing:
Program Mode (F2) -> Review Stepper (F3).

NOTE:

REFER TO"Chapter 8: LINEAR CURRENT STEPPERS" ON PAGE 197 FOR DETAILED INFORMATION REGARDING THE DESCRIPTION AND PROGRAMMING OF LINEAR CURRENT STEPPERS.

Chapter 5: COMMUNICATIONS SETUP

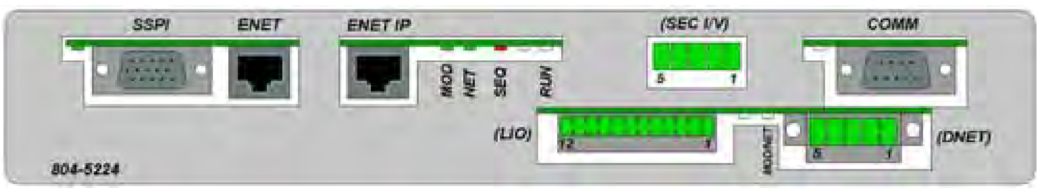


Figure 3.1 Gen6 Timer Face shown with DeviceNet option.

DESCRIPTION OF THE COMMUNICATION PORTS:

PORT NAME	COMMUNICATION TYPE	DESCRIPTION
SSPI	WTC Proprietary I/O Communication Protocol	SSPI supports communication with optional WTC I/O peripheral devices.
ENET IP	Ethernet/IP (EIP)	ENET IP is used for I/O communication between the weld timer and other Ethernet enabled devices (e.g. a Robot or PLC). Also used to communicate with Weld Gateway and ***RAFT™*** Gateway networking software. ENET IP can be used for updating timer software and maintenance functions.
ENET	Ethernet (Standard)	ENET is used for standard Ethernet communications. It also can be used for updating software and maintenance functions. ENET includes a web page interface for robot pendants or browser enabled devices.
LIO	Local (Discrete) I/O	Used for Isolation Contactor, Circuit breaker shunt trip, Fan, and Control Stop.
COMM	RS485 Serial Interface	COMM is used for DEP-300s or DEP-100S data entry panel communications.
DNET	DeviceNet	DNET is used with optional FieldBus connections.
SEC I/V	Secondary Current or Voltage Monitoring Input	Location for input wires for Secondary Current or Secondary Voltage Monitoring. (Optional)

The following pages describe the LED status for both the WT6000 and Gen6A processor.

WT6000 PROCESSOR LED DESCRIPTION

LED STATE	SSPI (SSPI COMMUNICATION STATUS)	MOD (ETHERNET/ IP MODULE STATUS)	NET (ETHERNET/IP NETWORK STATUS)	SEQ (WELD SEQUENCE STATUS)	RUN (WELD CONTROL STATUS)	COMM (DEP 300S/100S COMMUNICATION)
GREEN	SSPI Power	EIP functioning properly	EIP Connection established	Processing functions prior to weld	Control stop input high	Receiving Data
FLASHING GREEN		EIP initializing	Waiting on EIP connection	Weld control in NO WELD mode	Control stop input low	
RED		Error Non-Recoverable	Duplicate EIP Address	Processing WELD/HEAT functions	Mains Sync Error	Sending Data
FLASHING RED			EIP connection lost - Waiting to re-establish connection	-	Fault	
FLASHING RED AND GREEN						Actively receiving and sending Data when connected to DEP 300s/100s
AMBER	Power and Communication			Processing functions after weld		
FLASHING AMBER					Alert	
OFF				In weld mode- not in a sequence		

GEN6A PROCESSOR LED DESCRIPTION

LED STATE	SSPI COMM (SSPI COMMUNICATION STATUS)	MOD (ETHERNET/ IP MODULE STATUS)	NET (ETHERNET/ IP NETWORK STATUS)	NET 1 (ETHERNET NETWORK STATUS)	SEQ (WELD SEQUENCE STATUS)	RUN (WELD CONTROL STATUS)	COMM (DEP 300S/ 100S COMMUNICATION)
GREEN	SSPI Power	EIP functioning properly	EIP Connection established	Connection established	Processing functions prior to weld	Control stop input high	Receiving Data
FLASHING GREEN		EIP initializing	Waiting on EIP connection	Waiting on the connection	Weld control in NO WELD mode	Control stop input low	
RED		Error Non-Recoverable	Duplicate EIP Address	Duplicate ENET/EIP Address	Processing WELD/HEAT functions	Mains Sync Error	Sending Data
FLASHING RED			Connection lost - Waiting to re-establish connection	Connection lost - Waiting to re-establish connection		Fault	
FLASHING RED AND GREEN							Receiving and sending Data when connected to DEP300s/ 100s
AMBER	Power with Communication				Processing functions after weld		
FLASHING AMBER						Alert	
OFF			Not Configured	Not Configured	In weld mode- not in a sequence		DEP 300s/ 100s not connected

ETHERNET SETUP

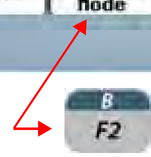
The WTC weld processor has two Ethernet communication ports:

PORT NAME	COMMUNICATION TYPE	DESCRIPTION
ENET	Standard Ethernet	ENET is used for standard Ethernet communications. It also can be used for updating software and maintenance functions. ENET includes a web page interface for robot pendants or browser enabled devices.
ENET IP	Ethernet/IP (EIP)	ENET IP is used for I/O communication between the weld timer and other Ethernet enabled devices (e.g. a Robot or PLC). It also can be used for updating timer software and maintenance functions. ENET IP includes a web page interface for robot pendants or browser enabled devices.

NOTE: Both ports on the Gen6A weld processor have Ethernet/ IP capability. Only one gateway can be programmed at a time. The ENET/IP designation is established via the programming access through different menus.
The following procedures explain how to program the two ports.

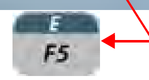
ENET (STANDARD ETHERNET)

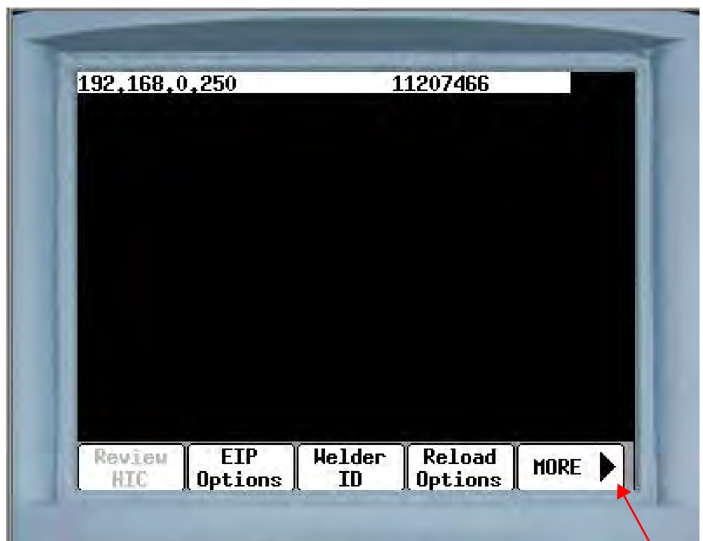
How to navigate using the DEP-300s to the Local Ethernet menu for ENET settings:



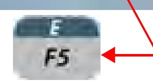
① Press Program Mode

② Press More





③ Press More



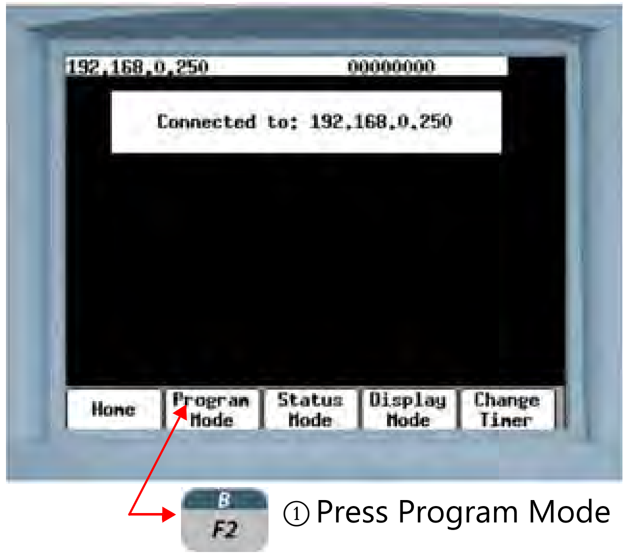
④ Press Local Ethernet

ENET FACTORY DEFAULT SETTINGS:

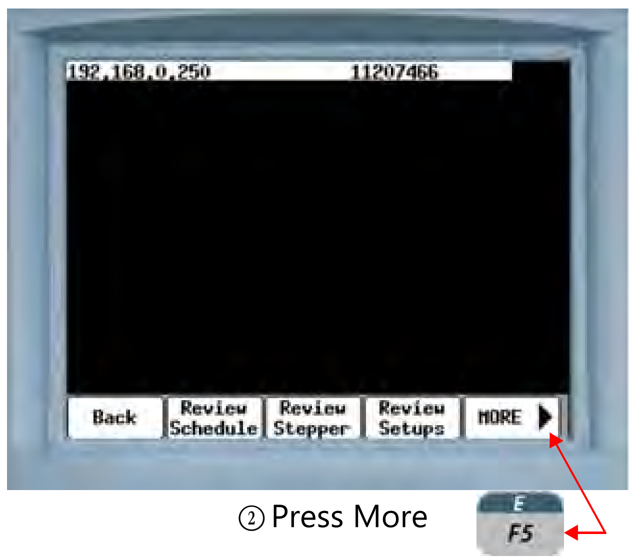
NAME	ADDRESS
IP Address	89.89.200.250
Sub Net Mask	255.255.255.0
Gateway	0.0.0.0

ENET IP (EIP)

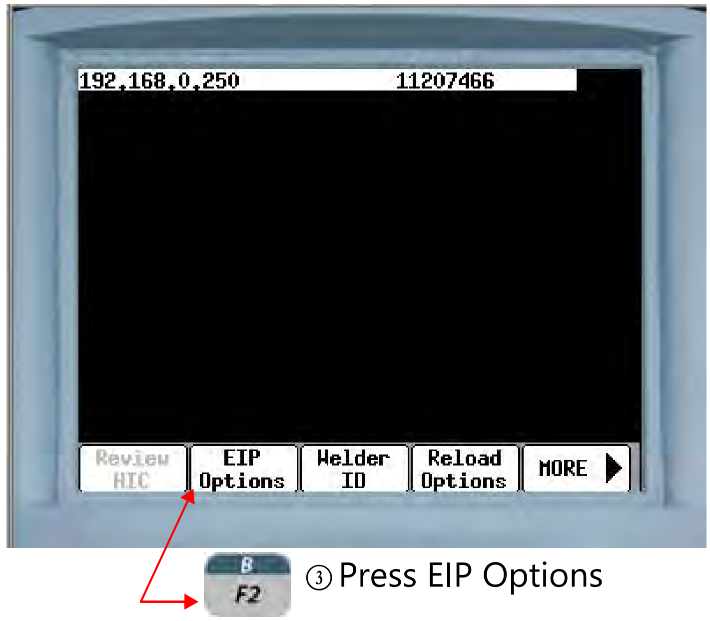
How to navigate using the DEP-300s to the EIP Options menu:



① Press Program Mode



② Press More



③ Press EIP Options

THE EIP FACTORY DEFAULT SETTINGS ARE AS FOLLOWS:

NAME	ADDRESS
IP ADDRESS	192.168.0.250
SUB NET MASK	255.255.0.0
GATEWAY	0.0.0.0
NAME SERVER	0.0.0.0
INPUT INSTANCE 150	Type: 8bit Size: 2
OUTPUT INSTANCE 100	Type: 8bit Size: 2
MAC ADDRESS	00:18:ec:01:e7:1f
DHCP	Off
DHCP MODE	retry disabled
PORT MODE	auto

NOTE: Reloading EIP factory defaults resets the password to 123456 on the *Web pages* and any previously set passwords are no longer valid.

SETTING THE NUMBER OF AVAILABLE EIP INPUTS AND OUTPUTS

There are a maximum of 64 inputs and 64 outputs that can be mapped. The number of mapped inputs and outputs is determined by selecting a Type and Size, whose product is less than or equal to 64.

The chart below shows all the possible combinations in which the Type and Size can be configured and not exceed the maximum of 64.

NOTE: If the Size is set to 0, the entire map is disabled and no I/O can be mapped.

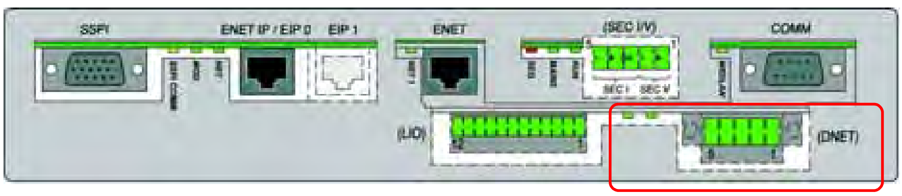
TYPE	SIZE	PRODUCT
8	0	0
8	1	8
8	2	16
8	3	24
8	4	32
8	5	40
8	6	48
8	7	56
16	0	0
16	1	16
16	2	32
16	3	48
32	0	0
32	1	32
32	2	64

DEVICENET SETUP

WTC weld processors installed with an optional DeviceNet peripheral board are capable of DeviceNet I/O communications. This module establishes a direct link between the control enclosure and host PLC.

The local and safety I/O are wired directly into the control cabinet. These connections provide inputs and outputs for local use and safety interlocks.

The DeviceNet integration scheme uses some of the same signals as those used in the discrete I/O operation. The major difference is that the I/O is transmitted over a DeviceNet link from the DeviceNet module (in the controller chassis).
This setup is accessed from the FieldBus menu



NOTE:

DO NOT WIRE INTO THE NETWORK WHILE THE NETWORK POWER SUPPLY IS TURNED ON. THIS MAY SHORT THE NETWORK OR DISRUPT COMMUNICATIONS. .

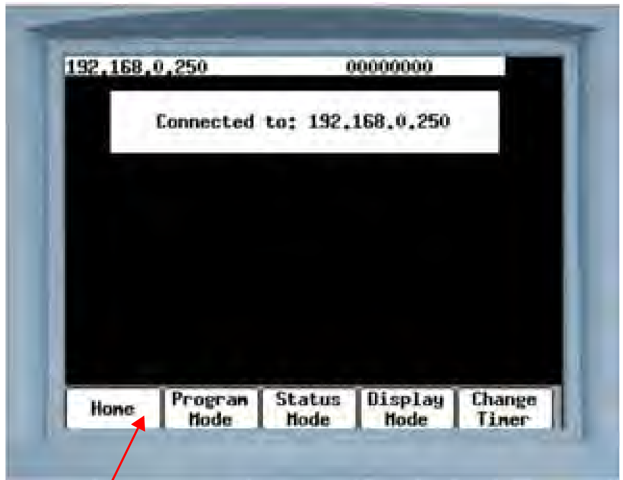
LED	STATUS	DESCRIPTION
● (black)	OFF	No 24V DNet Power
● (green)	Blinking	No Connection
	SOLID	Connected
● (red)	Blinking	Timeout Error

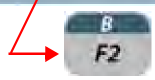
DEVICENET FACTORY DEFAULT SETTINGS:

NAME	ADDRESS
RELOAD DEFAULT	OFF
NODE ADDRESS	1
BAUD RATE	125K
BYTE SIZE	8by8
NETWORK RESPONSE DELAY IN mSEC.	1

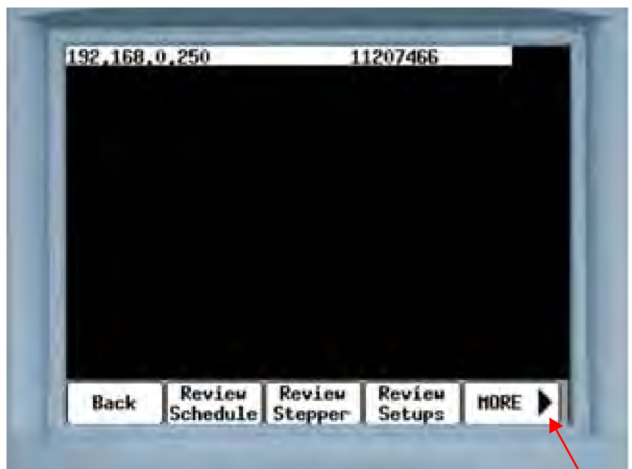
NOTE: These settings are the factory defaults. The customer's default settings may differ based on the welding application and the requirements of the DeviceNet master.

PROCEDURE TO NAVIGATE TO THE FIELDBUS MAPPING MENU USING THE DEP-300S:

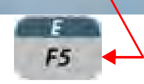


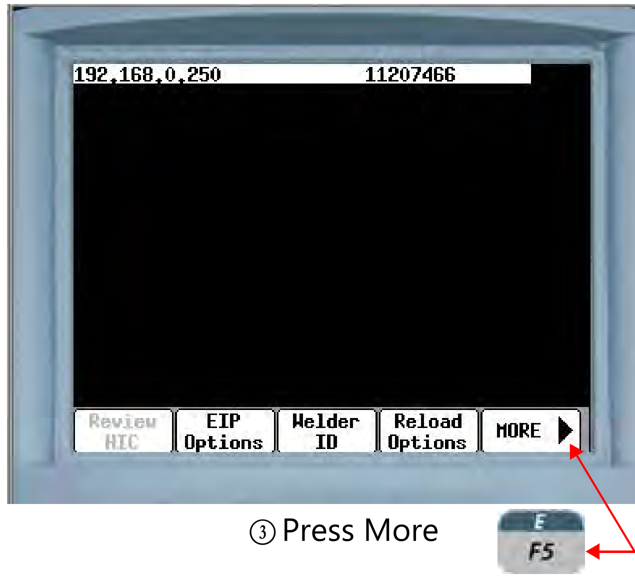


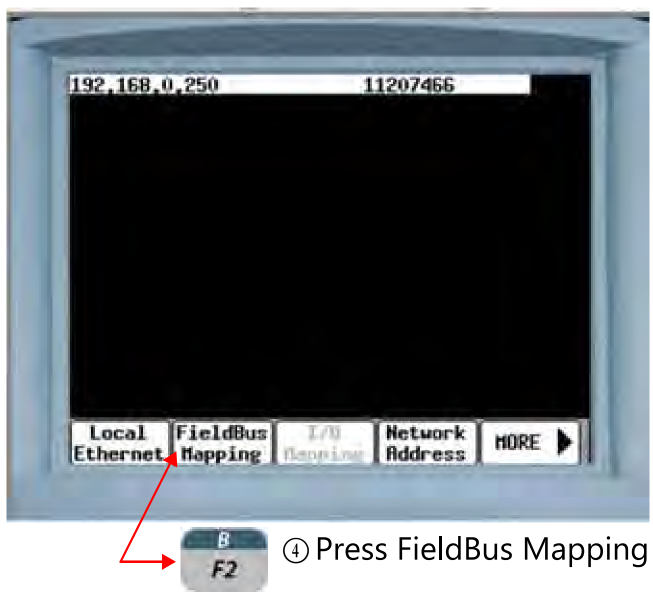
① Press Program Mode



② Press More







NOTE:

THE WTC6000 CONTROL IS DESIGNED TO USE EITHER DEVICENET OR DISCRETE I/O. WHEN CONFIGURING THE I/O FRO YOUR APPLICATION, BE CERTAIN THAT THE DEVICENET AND DISCRETE I/O DO NOT CONFLICT WITH EACH OTHER. CONFLICTING I/O WILL NOT ALLOW THE WELD CONTROL TO FIRE. AN EXAMPLE OF CONFLICTING I/O WOULD BE TO HAVE DIFFERENT I/O IN BOTH THE DISCRETE I/O MAP AND THE FIELDBUS I/O MAP. IF THE OPERATOR HAS PROGRAMMED MATCHING I/O MAPS FOR DISCRETE AND FIELDBUS I/O, THE FIELDBUS I/O TAKES PRECEDENCE.

PROFINET (PNET) SETUP

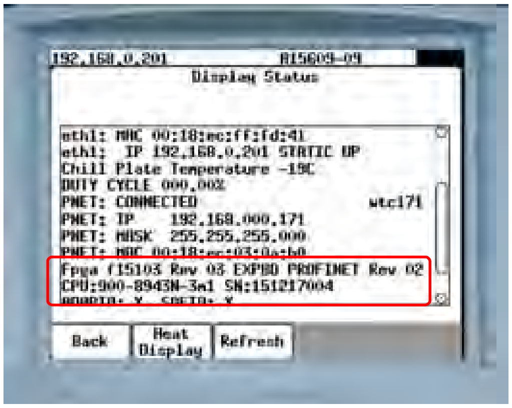
The WT6000 and Gen6A processors are capable of ProfiNet I/O communications. This requires the installation of an optional ProfiNet interface board.

In the example below, the Display Mode 

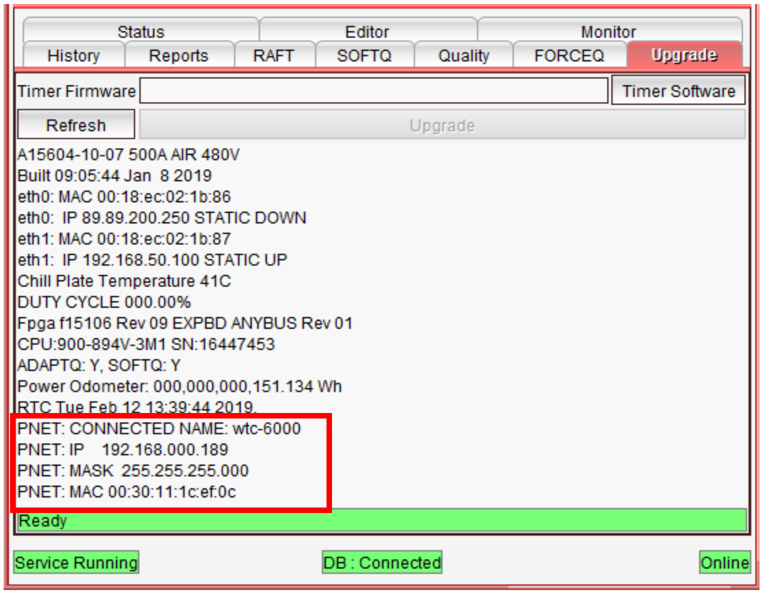
provides the user with information regarding the ProfiNet hardware status (circled in red) of the weld timer that the DEP is connected to.

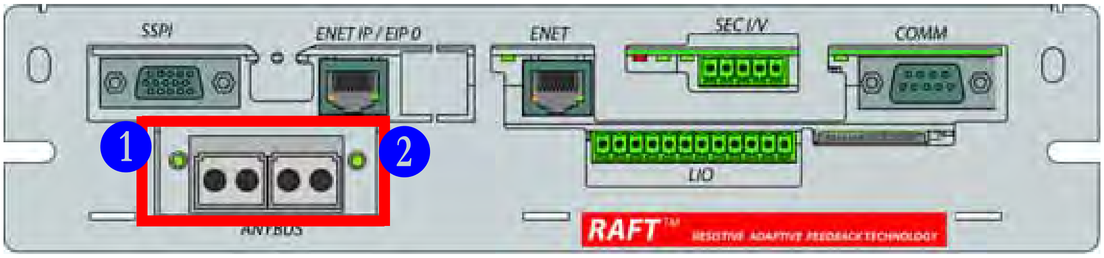
NOTE:

FOR PROFINET CABLING DIRECTIONS REFER TO HTTPS: WWW.PROFIBUS.COM/DOWNLOAD/PROFINET-INSTALLATION-GUIDELINES/



In the example below, the Upgrade tab provides the user with information regarding the ProfiNet hardware status (circled in red) of the weld timer that ***RAFT*** Gateway is connected to.

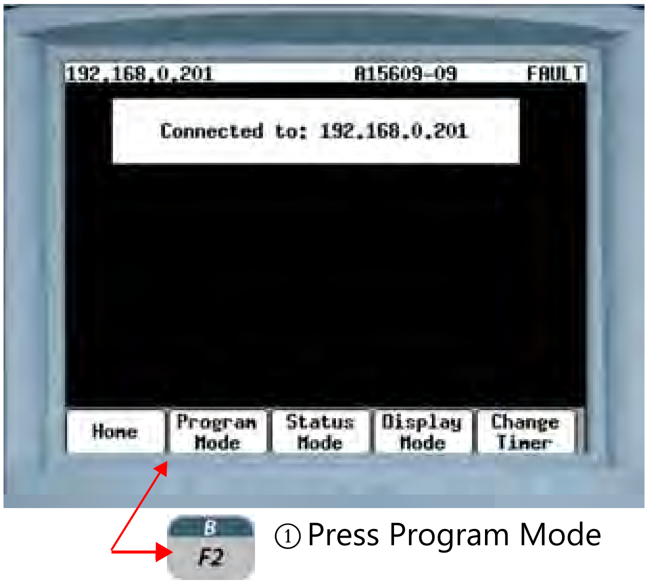


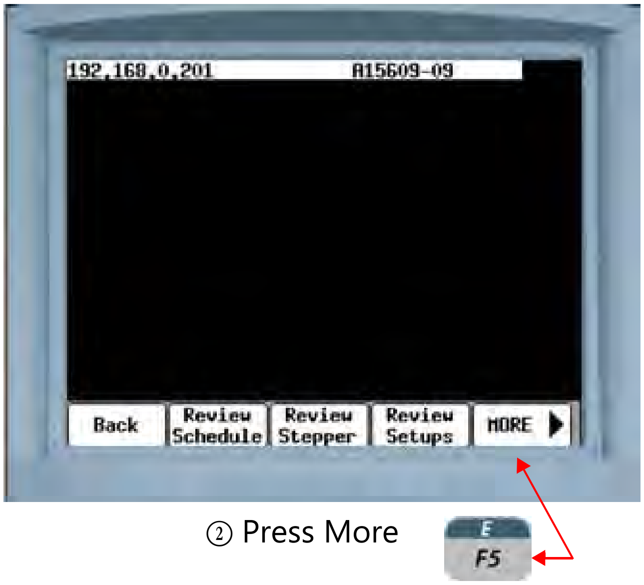


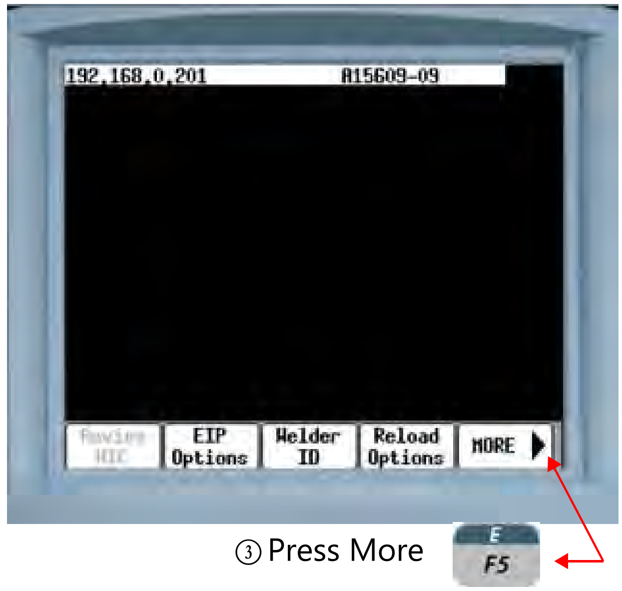
LED No.	LED State	Status	Description
1	● OFF	NOT INITIALIZED	No power or Module in SETUP or NW_INIT state
	● (green)	NORMAL OPERATION	Module has shifted from the NW_INIT state
	● (green) 1 Flash	DIAGNOSTIC EVENT	Diagnostic event(s) present
	● (green) Cont. Flash		Flashing 1Hz continuously to identify slave (DCP_Identify).
	● (red)	EXCEPTION ERROR FATAL EVENT	Major internal error (this indication is combined with a Red Network Status LED)
	● ● Alternating Red/Green	FIRMWARE UPDATE	Do NOT power off the module. Turning the module off during this phase could cause permanent damage.
2	● OFF	OFFLINE	No power or Module in SETUP or NW_INIT state
	● (green)	ONLINE (RUN)	Connection with IO controller established, IO controller in Run state
	● (green) 1 Flash	ONLINE (STOP)	Connection with IO controller established, IO controller in STOP state or IO data bad, IRT synchronization not finished
	● (green) 3 Flashes	IDENTIFY	Flashing 3 times (1Hz) continuously to identify slave (DCP_Identify).
	● (green) Cont. Flash	-	Connection with IO controller established, IO controller in STOP state
	● (red)	FATAL EVENT	Major internal error (this indication is combined with a red module status LED)
	● (red) 1 Flash	STATION NAME ERROR	Station name not set
	● (red) 2 flashes	IP ADDRESS ERROR	IP address not set
	● (red) 3 flashes	CONFIGURATION ERROR	Expected Identification differs from Real Identification.

PROFINET FACTORY DEFAULT SETTINGS

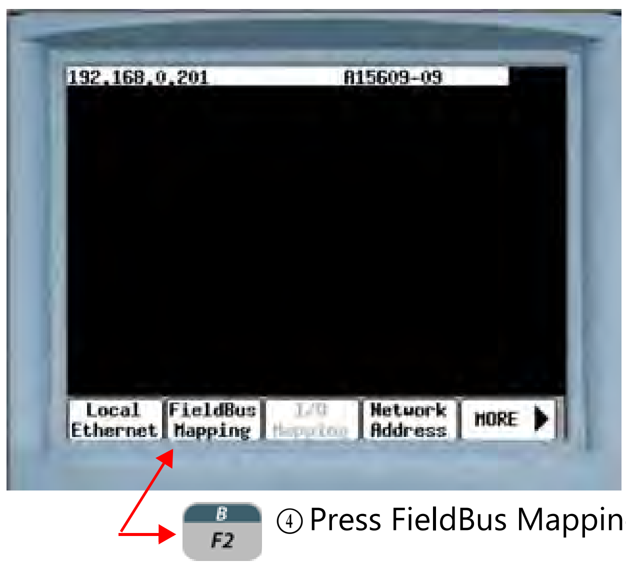
ProfiNet is programming is accessed via the FieldBus menu. The following procedure describes how to navigate using the DEP-300s to the FieldBus Mapping menu:



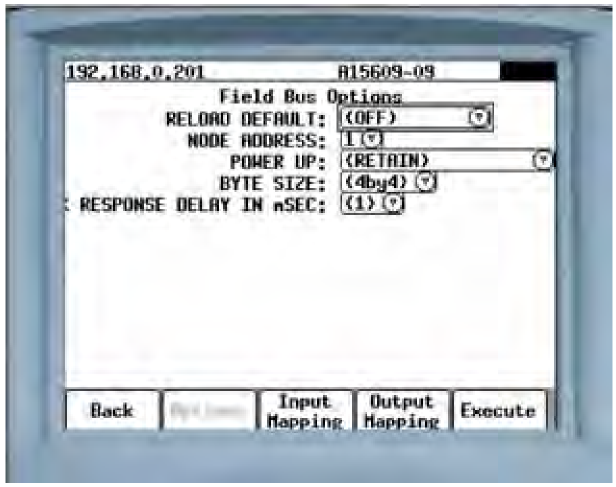




③ Press More



④ Press FieldBus Mapping



The programming screen is displayed with default settings.

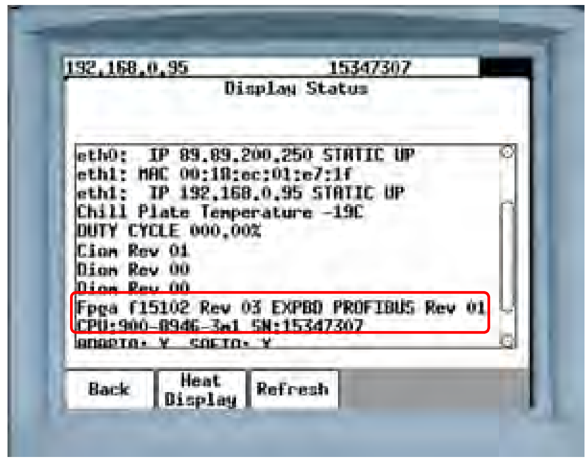
NAME	DEFAULT	OPTIONS	DESCRIPTION
RELOAD DEFAULT	OFF	OFF CLEAR IO DEFAULT 1 DEFAULT 2 DEFAULT 2	**CLEAR IO:** Sets all mappable fieldbus Inputs and Outputs to NONE. (Un-mapped) **DEFAULT 1/2/3:** Default I/O
NODE ADDRESS	1		Not programmable
POWER UP	RETAIN	RETAIN FACTORY DEFAULT	**RETAIN:** Keeps the previous PNet settings on power-up **FACTORY DEFAULT:** Goes to the factory default version on power-up
BYTE SIZE	8 by 8	2 by 2 4 by 4 6 by 6 8 by 8	ProfiNet always transfers 8 bytes in and out. The Byte Size determines how many of the 8 bytes are to be used. 2 by 2: 16 bits x 16 bits 4 by 4: 32 bits x 32 bits 6 by 6: 48 bits x 48 bits 8 by 8: 64 bits x 64 bits
NETWORK RESPONSE DELAY IN mSEC	1	1	Used for communicating with a robot. Typically a DEP requires a 1ms delay and a robot requires a 100ms delay.

PROFIBUS (PBUS) SETUP

ProfiBus I/O communications require the installation of an optional ProfiBus interface board.

In the example below, the Display Mode menu provides the user with information regarding the ProfiBus hardware status (circled in red) of the weld timer the DEP is connected to.

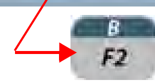
To access this screen press .



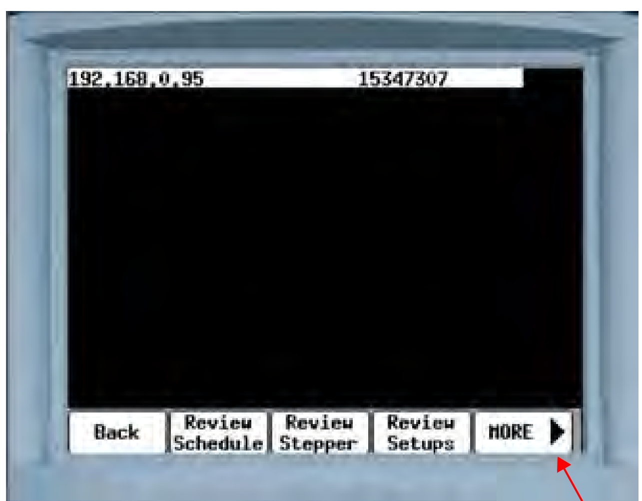
LED	STATUS	DESCRIPTION
●	ON	The ProfiBus interface board is functioning properly and ready to connect to the master ProfiBus device.
	OFF	The ProfiBus interface board has either not completed initializing or is not functioning properly.
●	ON	The ProfiBus interface is not connected to the master ProfiBus device.
	OFF	The ProfiBus interface is connected to the master ProfiNet device.

PROFIBUS FACTORY DEFAULT SETTINGS

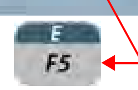
The ProfiBus settings are accessed from the FieldBus Mapping menu. The following procedure describes how to navigate to the FieldBus menu using the DEP-300s:



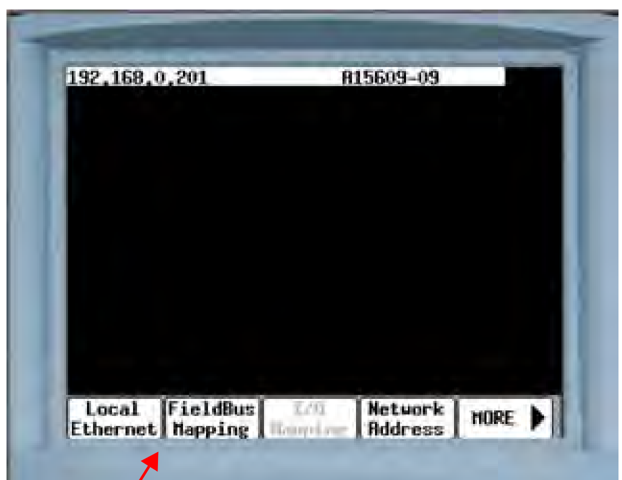
① Press Program Mode

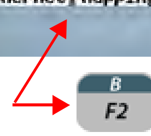


② Press More



③ Press More





④ Press FieldBus Mapping

The programming screen is displayed with default settings and programmable options.

NAME	DEFAULT	OPTIONS	DESCRIPTION
RELOAD DEFAULT	OFF	OFF CLEAR IO DEFAULT 1 DEFAULT 2 DEFAULT 3	**CLEAR IO:** Sets all mappable FieldBus Inputs and Outputs to NONE or unmapped. **DEFAULT 1/2:** Default I/O
NODE ADDRESS	1	1 - 126	Each node address refers to a weld control on the network that has previously been assigned a unique IP address.
baud rate	AUTO		Automatic Baud Rate detection allows the receiving device to accept data without having to establish data rates in advance.
POWER UP	RETAIN	RETAIN FACTORY DEFAULT	**RETAIN:** Keeps the previous PNet settings on power-up **FACTORY DEFAULT:** Goes to the factory default version on power-up
BYTE SIZE	8 by 8	2 by 2 4 by 4 6 by 6 8 by 8	The Byte Size determines how many of the bytes are to be used. 2 by 2: 16 bits x 16 bits 4 by 4: 32 bits x 32 bits 6 by 6: 48 bits x 48 bits 8 by 8: 64 bits x 64 bits
NETWORK RESPONSE DELAY IN mSEC	1	1	Used for communicating with a robot. Typically a DEP requires a 1ms delay and a robot requires a 100ms delay.

Chapter 4: WELD SCHEDULE FUNCTIONS

The WTC weld control is capable of storing up to 255 unique weld schedules. Each weld schedule can be assigned a maximum of 30 weld functions. A weld function is a command to the weld control to deliver a combination of heat (weld current) and time (weld time) to the weld interface, to create a weld nugget.

WELD SCHEDULE FUNCTIONS LIST

FUNC. NO.	FUNCTION NAME	CATEGORY
1.	SQUEEZE nnnn MSEC / CYCLES	DELAY
2.	COOL nnnn MSEC / CYCLES	DELAY
3.	HOLD nnnn MSEC / CYCLES	DELAY
4.	OFF nnnn MSEC / CYCLES	DELAY
5.	INITIAL SQUEEZE nnnn MSEC / CYCLES	DELAY
6.	"*"	
7.	WAIT nnnnn MSEC / CYCLES	DELAY
8.	PORTABLE GUN MODE	***RAFT™***
9.	"*"	
10.	"*"	
11.	MEASURE HIGH FORCE nnn TIME = nnn MS	SPECIAL

FUNC. NO.	FUNCTION NAME	CATEGORY
12.	MEASURE LOW FORCE nnn TIME = nnn MS	SPECIAL
13.	GAP RULE RD=nn	***RAFT™***
14.	"*"	
15.	DETAIL MODE	***RAFT™***
16.	MOTOR CURR LIMITS HI = nnn ma LO = nnn ma	SPECIAL
17.	TIP DRESS TIME nnn SEC BLANK nnn MS	SPECIAL
18.	START TIP DRESS MOTOR CHECK	SPECIAL
19.	STOP TIP DRESS MOTOR CHECK	SPECIAL
20.	WELD nnnn MS/IMP nn %VS	WELD
21.	TEMPER nnnn MS/IMP nn %VS	WELD
22.	PREHEAT nnnn MS/IMP nn %VS	WELD
23.	POSTHEAT nnnn MS/IMP nn %VS	WELD
24.	PRE-WELD nnnn MS/IMP nn %VS	WELD
25.	"*"	
26.	3T MODE	***RAFT***™
27.	EDGE WELD	***RAFT***™
28.	"*"	
29.	"*"	
30.	WELD nnnn MS/IMP nnnn0 AMPS	WELD
31.	TEMPER nnnn MS/IMP nnnn0 AMPS	WELD
32.	PREHEAT nnnn MS/IMP nnnn0 AMPS	WELD
33.	POSTHEAT nnnn MS/IMP nnnn0 AMPS	WELD
34.	PRE-WELD nnnn MS/IMP nnnn0 AMPS	WELD
35.	"*"	
36.	"*"	
37.	WELD nnn IMP HI = nnnn 0A LO - nnnn 0A	WELD
38.	"*"	
39.	EXP nnnn% CONTROL nnn% HEAT nnn% ENERGY	***RAFT***™
40.	SLOPE nn CY/IMP nn %VS TO nn %VS	SLOPE

FUNC. NO.	FUNCTION NAME	CATEGORY
41.	"*"	
42.	"*"	
43.	TIP CHECK nn CY/IMP nnnn0A +/-nn uOHM	***RAFT***™
44.	"*"	
45.	SLOPE nnnn CY/IMP nnn0 A TO nnn0 A	SLOPE
46.	ADAPTQ MODE = nn RATE = nnn% WSLIDE = nnn%	***RAFT***™
47.	ADAPTQ IMX =nnnn O IMN =nnnn 0	***RAFT***™
48.	"*"	
49.	"*"	
50.	TURN ON VALVE nnn	I/O
51.	TURN OFF VALVE nn	I/O
52.	TURN ON OUTPUT nn	I/O
53.	TURN OFF OUTPUT nnnn	I/O
54.	TURN ON PRESSURE SELECT nnnn	I/O
55.	TURN OFF PRESSURE SELECT nn	I/O
56.	TURN ON CONTACTOR SELECT nnnn	I/O
57.	TURN OFF CONTACTOR SELECT nnnn	I/O
58.	TURN ON WELD IN PROGRESS	I/O
59.	TURN OFF WELD IN PROGRESS	I/O
60.	IMPULSE= nnnn HEAT MS nnnn COOL MSEC/ CYCLES	WELD
61.	ABORT IF NO INITIATE FOR nnnn MSEC / CYCLES	I/O
62.	REPEAT (AT NEXT FUNCTION)	SPECIAL
63.	TURN ON WELD COMPLETE	I/O
64.	TURN OFF WELD COMPLETE	I/O
65.	ISOLATION CONTACTOR DELAY = nnn SEC.	EXTEND
66.	WAIT nnn CY INP #nn TO BE nn (0 = OFF 1 = ON)	I/O
67.	WAIT FOR INPUT #nn TO BE nn (0 = OFF 1 = ON)	I/O
68.	WAIT nnnn MS/CY FOR PRESSURE SWITCH INPUT	I/O

FUNC. NO.	FUNCTION NAME	CATEGORY
69.	WAIT FOR PRESSURE SWITCH INPUT	I/O
70.	WAIT FOR WELD PROCEED	I/O
71.	SET VALVE nnn CYLINDER PRESSURE nnn PSI	I/O
72.	SET VALVE nnn TOUCHDOWN PRESSURE nnn	I/O
73.	SET VALVE nn TIP DRESS PRESSURE nnnn PSI	I/O
74.	WAIT nnn CY FOR PRESSURE ACHIEVED	I/O
75.	EXTEND UNTIL NO INITIATE	EXTEND
76.	SEC. CURR LIMITS: HI=nnnn0 LOW=nnnn0	SPECIAL
77.	EXTEND WHILE INPUT #nnnn IS nn (0=OFF 1 = ON)	EXTEND
78.	TURN ON FORGE VALVE	I/O
79.	TURN OFF FORGE VALVE	I/O
80.	FORGE DELAY nnn MS	I/O
81.	TRANSFORMER TURNS RATIO nnnn:1	SPECIAL
82.	LINEAR STEPPER #nn ASSIGNED (0 = OFF)	SPECIAL
83.	FORGE FORCE nnnn	SPECIAL
84.	"*"	
85.	PROCESS WELD FAULTS	SPECIAL
86.	VERIFY CYLINDER # nnn IS OUT OF RETRACT	SPECIAL
87.	"*"	
88.	TURN ON ISOLATION CONTACTOR	I/O
89.	TURN OFF ISOLATION CONTACTOR	I/O
90.	SET SPC OFFSET TO nnn	SPECIAL
91.	SEND ALL SAMPLES UNTIL NEXT SPC OFFSET	SPECIAL
92.	C-FACTOR LIMIT: HI=nnnn LO=nnnn	SPECIAL
93.	TIP DRESS ADVANCE: GROUP nnnn - STEP nn	SPECIAL
94.	EXTEND WELD IF LOW CURRENT LIMIT FAULT	EXTEND
95.	EXTEND WELD IF CURRENT LESS THAN nnnn0	EXTEND
96.	"*"	
97.	ROBOT MODE = nn	***RAFT***™

FUNC. NO.	FUNCTION NAME	CATEGORY
98.	HIGH STRENGTH STEEL MODE	***RAFT***™
99.	GO TO SEQ#nnn	SPECIAL

NUMBERS WITH "*" APPEARING IN THE LINE, INDICATE NO FUNCTION IS ASSIGNED TO THAT NUMBER. UNASSIGNED FUNCTION NUMBERS ARE NOT DISPLAYED.

DELAY FUNCTIONS

Delay functions cause a delay (or wait) time to occur in the weld schedule for a specified length of time. All delay functions essentially perform the same function, but are assigned different names to describe their purpose in the welding process. During delay functions, weld current does not flow and I/O status does not change.

FUNC. NO.	FUNCTION NAME
1	SQUEEZE nnnn MSEC / CYCLES
2	COOL nnnn MSEC / CYCLES
3	HOLD nnnn MSEC / CYCLES
4	OFF nnnn MSEC / CYCLES
5	INITIAL SQUEEZE nnnn MSEC / CYCLES
7	WAIT nnnn MSEC / CYCLES

WELD FUNCTIONS

The purpose of a weld function is to deliver a specific amount of weld current to the weld interface for a specific amount of time. The WT6000 weld control uses two modes to supply regulated current to the weld interface: Percent of available volt-second (%VS) and Constant Current Welding (AMPS). See Chapter 9: Advanced Topics for more information.

WARNING!

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, ACTUAL POWER CAPACITY AND NOMINAL LINE VOLTAGE. EXPERIMENT WITH THE CONTROL TO DETERMINE THE UPPER AND LOWER RANGE OF CURRENT EACH CONTROL CAN PROVIDE.

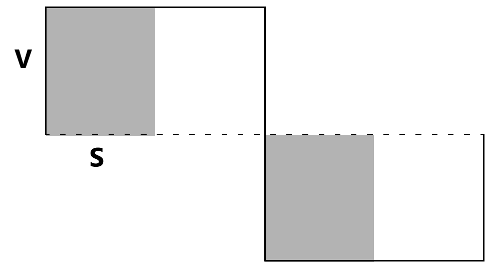
WELD FIRING MODES

The purpose of the weld function is to deliver a specific amount of weld current to the weld interface for a defined amount of time. The WT6000 weld control uses two modes to supply regulated current to the weld interface: Percent of Available Volt-Second (%VS) Welding and Constant Current Welding (AMPS). See “Chapter 9: Advanced Topics” on page 216 for more information.

▶ **PERCENT OF AVAILABLE VOLT-SECOND WELD FUNCTIONS**

Percent of Available Volt-Second (%VS) welding can be viewed as a way of accomplishing AVC (Automatic Voltage Compensation) in a MFDC inverter. In the example below, “S” (IGBT on-time) is adjusted to keep the effective voltage applied to the welding transformer constant. So, if the DC bus voltage goes higher, the IGBT's shut off earlier. Conversely, if the DC bus voltage goes lower, the IGBT's shut off later. This allows the volume of the shaded area to remain constant.

Inverter Output



.

FUNC. NO.	FUNCTION NAME
20	WELD nnnn MS/IMP nn %VS
21	TEMPER nnnn MS/IMP nn %VS

FUNC. NO.	FUNCTION NAME
22	PREHEAT nnnn MS/IMP nn %VS
23	POSTHEAT nnnn MS/IMP nn %VS
24	PRE-WELD nnnn MS/IMP nn %VS
40	SLOPE nnnn MS/IMP nn %VS TO nn %VS

- **CONSTANT CURRENT WELD FUNCTIONS**

In Constant Current welding, current value is entered as the actual amount of secondary current required (e.g. 5,000A, 10,000A, etc.). Weld functions that have AMPS at the end of the function fire in constant current. These functions specify a set amount of secondary current, displayed as nnnn0 AMPS. In constant current mode, the weld control monitors the current during each cycle. It compensates for changes at the level programmed. This method does NOT compensate for changes in the welder secondary circuit.

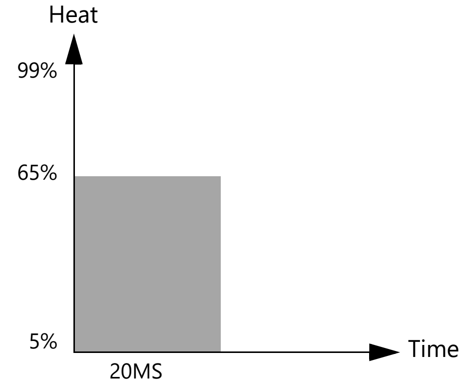
THE TRANSFORMER TURNS RATIO SETUP PARAMETER MUST BE ACCURATELY PROGRAMMED FOR THE CONTROL TO SUPPLY THE CORRECT AMOUNT OF SECONDARY CURRENT IN CONSTANT CURRENT FIRING MODE.

FUNC. NO.	FUNCTION NAME
30	WELD nnnn MS. nnnn0 AMPS
31	TEMPER nnnn MS. nnnn0 AMPS
32	PREHEAT nnnn MS. nnnn0 AMPS
33	POSTHEAT nnnn MS. nnnn0 AMPS
34	PRE-WELD nnnn MS. nnnn0 AMPS

MAIN WELD FUNCTION (#20)

In the following Volt-Second Mode example, the processor will weld for 20 milliseconds at 65% volt-seconds:

20	WELD 20 MS. 65 %VS



WARNING!

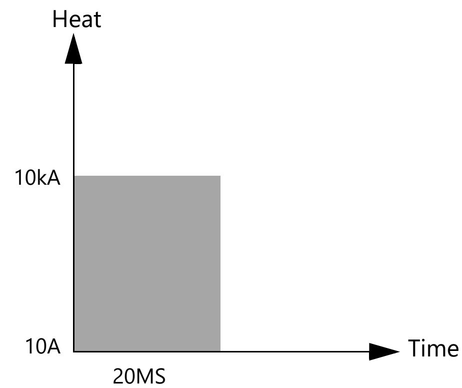
WHEN FUNCTION IMPULSE =NNNN HEAT MS, NNNN COOL MS (NNNN= 1-9999) APPEARS BEFORE ANY WELD FUNCTION IN A SCHEDULE, THE CONTROL DISPLAYS IMP (IMPULSES) RATHER THAN MS (MILLISECONDS) TO INDICATE THE WELD CONTROL WILL PULSATION WELD.

MAIN WELD FUNCTION (#30)

In Constant Current Mode all values of weld current are in Amps. For a programmed value of weld current, the control will pass this amount of current during the WELD function, regardless of the amount of metal between the weld gun's tips or the stack-up of metal. (This only applies if the welding system can deliver the requested current.).

In the following example, the processor will weld for 20 milliseconds at 10000A current:

30	WELD 20 MS. 10000 AMPS



YOU MUST SPECIFY THE CORRECT TRANSFORMER TURNS RATIO (ESPECIALLY IF WELDING TRANSFORMER HAS MULTIPLE SECONDARY TAPS). OBTAIN THIS DATA FROM THE TRANSFORMER'S RATING PLATE OR MANUFACTURER.

THE TRANSFORMER TURNS RATIO VALUE MUST BE ACCURATELY PROGRAMMED FOR THE CONTROL TO SUPPLY THE CORRECT AMOUNT OF SECONDARY CURRENT WHILE FIRING IN CONSTANT CURRENT MODE. AN EXCEPTION IS WHEN FIRING IN SECONDARY CURRENT MODE WHILE USING A SECONDARY-CURRENT SENSING DEVICE. THEN, SECONDARY CURRENT IS A DIRECT READING, WITHOUT CALCULATIONS REGARDING THE TURNS RATIO.

TEMPER, PREHEAT, POST-HEAT AND PREWELD FUNCTIONS

Temper, Preheat, Post-Heat and Pre-Weld are material heating functions and are inserted either before or after main weld functions (#20 or #30). They all essentially perform the same function, but are assigned different names to describe their purpose in the welding process. These functions are not figured into the weld data collection algorithm. For example:

Example 1: Using a Preheat Function before the Weld Function

32	PREHEAT 20 MS. 5000 AMPS
30	WELD 20 MS. 10000 AMPS

When the weld sequence is complete, the last weld data in the Weld Data Menu will display 10,000 Amps. As mentioned above, the preheat function is not figured in the weld data collection algorithm.

Example 2: Using two weld functions, with the first as a preheat

30	WELD 20 MS. 5000 AMPS
30	WELD 20 MS. 10000 AMPS

When the weld sequence is complete, the last weld data in the Weld Data Menu will display 7,500 Amps. This is because when two or more weld functions are used in the same weld schedule, the weld data collection algorithm calculates the average current for all the weld functions and displays the results.

IMPULSE WELDING FUNCTION

The impulse weld function defines the length of a weld impulse. It tells the weld processor that the next function in the schedule should be a in pulsation weld (providing heat times followed by cool times in repetitive fashion, rather than just heat). The weld control firmware offers two different methods of pulsation (impulse) welding. The first method has NO-HEAT cool times between the impulses and the second has LOW-HEAT cool times between the impulses.

This instruction is placed before main weld functions (#20 or #30) and can be used in either Volt Second or Constant Current mode welding.

NOTE:

WHEN THIS FUNCTION IS USED IN CONJUNCTION WITH THE MAIN WELD FUNCTION (#20 OR #30), THE WELD PROCESSOR CHANGES THE WELD FUNCTION TO DISPLAY IMPULSES (IMP) RATHER THAN MILLISECONDS (MS).

ALTHOUGH FUNCTION #60 IS TYPICALLY USED IN CONJUNCTION WITH MAIN WELD FUNCTIONS (#20 OR #30), IT CAN ALSO BE USED BEFORE ANY WELD OR SLOPE FUNCTION.

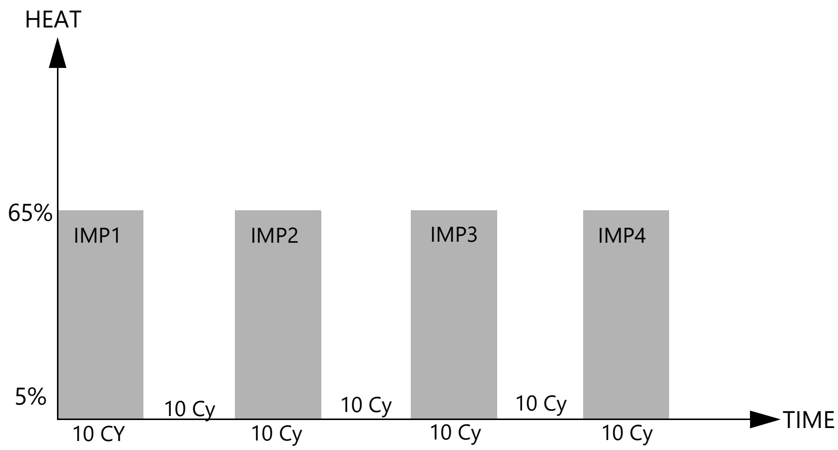
METHOD #1: IMPULSE WELDING WITH “NO-HEAT” COOL TIME:

In the following example, the weld processor will weld (heat) for 10 MS at 65% volt-seconds, then wait (cool) for 10 MS, and repeat the pattern 4 times. As illustrated in the timing chart, no current is flowing during the cool times

60	IMPULSE= 10 HEAT MS 10 COOL MS
20	WELD 4 IMP 65%VS

METHOD #2: IMPULSE WELDING WITH “LOW-HEAT” COOL TIME:

In this method, the impulse instruction (function #60) is inserted in the weld schedule before Constant Current function #37 (WELD nnn IMP HI=nnnn0 A LO=nnnn0 A).



FUNC. #	FUNCTION NAME	DESCRIPTION
60	IMPULSE= nnnn HEAT CY/MS nn COOL CY/MS	Impulse heat and cool times
37	WELD nnn IMP HI =nnn A LO =nnn 0 A	The number of weld impulses and the amount of current during the impulse (HI) and cool (LO) times.

Function #60 defines the length of the impulse heat time and the length of the cool time after each impulse. Function #37 defines the number of impulses and the amount of current during each impulse and the LOW current during each cool time.

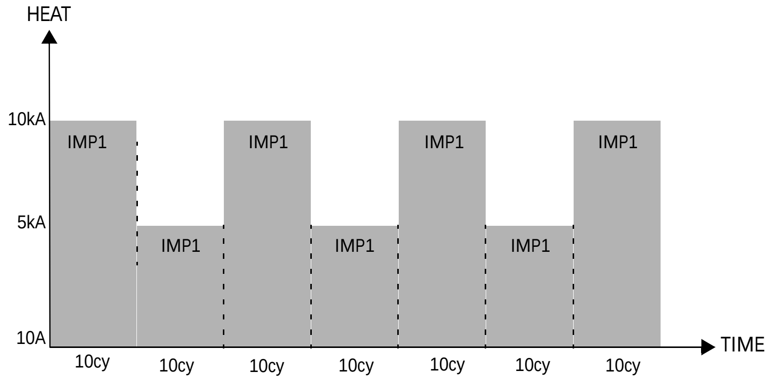
In the example below, the weld processor will weld (heat) for 10 cycles and then cool (at low heat) for 10 cycles. This heat and cool impulse pattern will occur (4) times at 10,000 Amps during each impulse and 5000 Amps during each cool time.

60	IMPULSE= 10 HEAT CY 10 COOL CY
*37	WELD **4 IMP** HI=10000 A LO=5000A

*NOTE: Function # 37 available in certain software only.

SLOPE FUNCTIONS

Slope functions are used when either a linear increase (Up-Slope) or decrease (Down-Slope) in welding current is required over a specified amount of time.



Up-Slope: Provides current at the first value and increases it to the second value over the length of time specified.

Down-Slope: Provides current at the first value and decreases it to the second value over the length of time specified.

Typically, Up-Slope functions are used before main weld functions (#20 or #30) and Down-Slope functions are used after main weld functions (#20 or #30).

SLOPE FUNCTION (PERCENT VOLT-SECOND MODE)

FUNC. NO.	FUNCTION NAME	DESCRIPTION
40	SLOPE nnnn CY/IMP nn %VS TO nn %VS	Slope time in Cycles from percent volt-second value 1 (nn%VS) to percent volt-second value 2 (nn %VS)
NOTE: This function is used in conjunction with main weld Function No. 20		

SLOPE FUNCTION (CONSTANT CURRENT MODE)

FUNC. NO.	FUNCTION NAME	DESCRIPTION
45	SLOPE nnnn CY/IMP nnnn0 A TO nnnn0 A	Slope time in milliseconds from current value 1 (nnnn0 A) to current value 2 (nnnn0 A)
NOTE: This function is used in conjunction with main weld Function No. 30		

In the following up-slope weld example, the weld processor will begin welding at 35% volt-seconds and increase to 65% volt-seconds over a

40 cycle time period. Then the processor will weld at 65% volt-seconds for 20 cycles.

40	SLOPE 40 CY. 35%VS TO 65%VS
20	WELD 20 CY. 65%VS

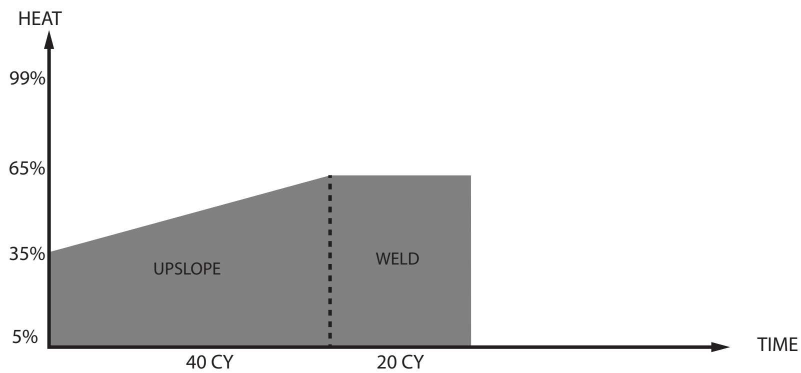


Figure 4.1 Above: Example of a linear Up-Slope function (#40)

NOTE: JUST AS THE HEAT FUNCTIONS MENTIONED EARLIER, THE SLOPE FUNCTIONS ARE NOT FIGURED INTO THE WELD DATA COLLECTION ALGORITHM. THEREFORE, THEIR VALUE IS NOT AVERAGED INTO THE LAST WELD DATA VIEWED IN THE WELD DATA MENU

I/O FUNCTIONS

I/O functions are used to verify the status of, changed status of, or wait, for certain I/O points to change states before continuing with the weld schedule.

There are two types of I/O Functions:

- Functions that interact with inputs
- Functions that interact with outputs

INPUT FUNCTIONS

FUNC. NO.	FUNCTION NAME	DESCRIPTION
61	**ABORT IF NO INITIATE FOR NNNN CYCLES / MS**	This function monitors the Weld initiate bit for the number of cycles /milliseconds specified. The control waits the number of CY/MS 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 INITIATE NOT PRESENT FAULT.
66	**WAIIT NNN CY INP #N TO BE N (0 =OFF 1 =ON)**	This function waits the specified amount of time (cycles) for the specified User input bit (1-6) to go either OFF (0) or ON (1). If the bit does not go either OFF or ON during this time period, a WELD PROCEED FAULT is generated. **NOTE:** IF WELD PROCEED IS SET TO ***FAULT*** IN THE SETUP PARAMETERS, AND THE FUNCTION IS SET TO OFF (0), THE WELD SCHEDULE IS EXECUTED IN NO WELD MODE (WHICH MEANS NO CURRENT IS PASSED). **NOTE:** IF WELD PROCEED IS SET TO ***ALERT*** IN THE SETUP PARAMETERS, AND THIS FUNCTION IS SET TO OFF (0), THE WELD SCHEDULE IS EXECUTED IN WELD MODE.
67	**WIAIT FOR INPUT #N TO BE N (0 =OFF 1= ON)**	This function waits for the specified User input bit (1-6) to go either OFF (0) or ON (1). If the Weld initiate input bit goes LOW before this occurs, a WELD PROCEED FAULT is generated.
68	**WAIT NNNN MS FOR PRES-SURE SWITCH INPUT**	This function waits the specified amount of time (cy/ms) for the Pressure Switch bit to go HIGH. if the bit does not go HIGH during this time period, a PRESSURE SWITCH FAULT is generated. **NOTE:** IF THE PRESSURE SWITCH BIT (PS1) IS LOW AND PRESSURE SWITCH IS SET TO ***FAULT*** IN SETUP PARAMETERS, THE WELD PROCESSOR WILL EXECUTE THE WELD SCHEDULE IN NO WELD MODE (WHICH MEANS NO CURRENT IS PASSED). **NOTE:** IF THE PRESSURE SWITCH BIT (PS1) IS LOW AND THE PRESSURE SWITCH PARAMETER IS SET TO ***ALERT***, THE WELD PROCESSOR WILL EXECUTE THE WELD SCHEDULE IN WELD MODE.
69	**WAIT FOR PRESSURE SWITCH INPUT**	This function waits for the Pressure Switch input bit to go HIGH.
70	**WAIT FOR WELD PROCEED**	This function waits indefinitely for the Weld Proceed input bit to go HIGH. If the Weld Proceed input goes low before this occurs, a Weld Proceed fault is generated.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
71	**SET VALVE NNN CYLINDER PRESSURE NNN PSI**	This function sets the specified valve bit (1-2) to the specified cylinder pressure in PSI. **NOTE:** THIS FUNCTION REQUIRES THE OPTIONAL ANALOG I/O MODULE (AIOM) TO BE INSTALLED IN THE WELD CONTROL.
72	**SET VALVE N TOUCH DOWN PRESSURE NNNN PSI**	This function sets the specified valve bit (1-2) to the specified touch down pressure in PSI. **NOTE:** THIS FUNCTION REQUIRES THE OPTIONAL ANALOG I/O MODULE (AIOM) TO BE INSTALLED IN THE WELD CONTROL.
73	**SET VALVE N TIP DRESS PRES-SURE NNNN PSI**	This function sets the specified valve bit (1-2) to the specified tip dress pressure in PSI. **NOTE:** THIS FUNCTION REQUIRES THE OPTIONAL ANALOG I/O MODULE (AIOM) TO BE INSTALLED IN THE WELD CONTROL.
74	**WAIT NN MS FOR PRESSURE ACHIEVED**	This function waits for the number of milliseconds specified for the cylinder pressure to be achieved. If the pressure is not achieved during this time period, a PRESSURE NOT ACHEIVED FAULT is generated. **NOTE:** THIS FUNCTION MUST BE USED AFTER ANY SET PRESSURE FUNCTION. OTHERWISE, THE WELD PROCESSOR WILL NOT KNOW IF PRESSURE WAS ACHIEVED BEFORE EXECUTING THE WELD FUNCTION. **NOTE:** THIS FUNCTION REQUIRES THE OPTIONAL ANALOG I/O MODULE (AIOM) TO BE INSTALLED IN THE WELD CONTROL.
78	**TURN ON FORGE VALVE**	Turns ON Forge Valve bit.
79	**TURN OFF FORGE VALVE**	Turns OFF Forge Valve bit.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
93	**TIP DRESS ADVANCE: GROUP NN - STEP N**	This function advances all the steppers assigned to the specified GROUP number, to the specified STEP number. For example, if this function was programmed: TIP DRESS ADVANCE: GROUP 02 - STEP 05, every stepper assigned to Group #2 would advance to Step #5. **NOTE:** THIS FUNCTION MUST BE INSERTED INTO A TIP DRESS SCHEDULE, IF THE TIP DRESS SCHEDULE IS USED IN LIEU OF THE TIP DRESS, TIP DRESS GROUP 1 OR TIP DRESS GROUP 2 INPUT BITS. **NOTE:** 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 IN THE SAME GROUP COMPLETES A WELD.

OUTPUT FUNCTIONS

FUNC. NO.	FUNCTION NAME	DESCRIPTION
50	**TURN ON VALVE NNNN**	Turn ON Valve bit (1-6).
51	**TURN OFF VALVE NNNN**	Turn OFF Valve bit (1-6).
52	**TURN ON OUTPUT NN**	Turn ON User Output bit (1-6).
53	**TURN OFF OUTPUT NN**	Turn ON User Output bit (1-6).
54	**TURN ON PRESSURE SELECT N**	Turn ON Pressure Select bit (1-4).
55	**TURN OFF PRESSURE SELECT N**	Turn OFF Pressure Select bit (1-4).
56	**TURN ON CONTACTOR SELECT N**	Turn ON Contactor Select bit (1-6)
57	**TURN OFF CONTACTOR SELECT N**	Turn OFF Contactor Select bit (1-6)
58	**TURN ON WELD IN PROGRESS**	Turn on Weld in Progress bit.
59	**TURN OFF WELD IN PROGRESS**	Turn off Weld in Progress bit.
63	**TURN ON WELD COMPLETE**	Function Turn on the Weld Complete will only activate the Weld Complete output under the following conditions: 1. There are no active fault conditions 2. The Binary Select or Weld initiate input is still active. This function also 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.
64	**TURN OFF WELD COMPLETE**	This function will deactivate the WELD COMPLETE output under the following conditions: 1. A fault occurs 2. The Binary Select or Weld initiate input is still active.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
80	**FORGE DELAY NNN MS**	Inserted in the weld schedule before function #78 (TURN ON FORGE VALVE), this function delays turning on the Forge Valve bit for the number of milliseconds specified. **NOTE:** WHEN THE FORGE DELAY FUNCTION IS INSERTED AT THE END OF A SCHEDULE THE FORGE VALVE WILL NOT TURN ON. THE FORGE DELAY FUNCTION IS TYPICALLY INSERTED IMMEDIATELY AFTER THE WELD FUNCTION. A TURN OFF FORGE VALVE MUST BE INSERTED AFTER THE FORGE DELAY FUNCTION. FAILURE TO USE THE TURN OFF FORGE VALVE WILL RESULT IN THE FORGE VALVE REMAINING ON INDEFINITELY UNTIL THE CONTROL POWER IS INTERRUPTED.
88	**TURN ON ISOLATION CONTACTOR**	This function 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.
89	**TURN OFF ISOLATION CONTAC-TOR**	The function TURN OFF ISOLATION CONTACTOR will first check to determine if the isolation contactor is closed, and will release the isolation contactor only if it is open. **NOTE:** ALL NON-WELDING SCHEDULES SUCH AS TIP DRESS SCHEDULES MUST BE EXECUTED IN NO WELD TO KEEP THE ISOLATION CONTACTOR OFF DURING A NON WELD SCHEDULE.

EXTEND FUNCTIONS

Extend functions are used to extend a function under certain conditions.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
65	**ISOLATION CONTACTOR DELAY = NN SEC.**	This function delays the opening of the isolation contactor for the number of seconds specified, if the isolation contactor Saver bit is HIGH. This is designed to prevent wear on the isolation contactor caused by dropping in and out between welds. If ISOLATION CONTACTOR SAVER input is available and set LOW, it disables this delay timer.
75	**EXTEND UNTIL NO INITIATE**	This function tells the processor to monitor the status of the Weld initiate bit and to extend the previous function in the weld schedule until it detects that the Weld initiate input is inactive. **NOTE:** A FAULT CONDITION OVERRIDES THIS FUNCTION AND THE SCHEDULE PROGRESSES WITHOUT WAITING FOR THE WELD INITIATE BIT.
94	**EXTEND WELD IF LOW CURRENT LIMIT FAULT**	This function tells the processor to automatically repeat the weld function if it detects a LOW CURRENT LIMIT FAULT. This function must appear immediately after the PROCESS WELD FAULTS function in the schedule and generates the EXTENDED WELD FAULT/ALERT condition. The weld function is extended only once. if the desired current is not reached on the re-weld, a LOW CURRENT LIMIT FAULT is generated. **NOTE:** REPEAT AND EXTEND FUNCTIONS ARE MUTUALLY EXCLUSIVE. DO NOT USE THE REPEAT FUNCTION WITH ANY EXTEND FUNCTION IN A WELD SCHEDULE.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
95	**EXTEND WELD IF CURRENT LESS THAN NNNN0**	This function tells the processor to extend the weld function if secondary current is less than the value programmed (nnnn0). The weld function is extended only once. if the desired current is not reached on the re-weld, an EXTENDED WELD ALERT is generated. **NOTE:** THERE IS ARE FAULT CONDITIONS ASSOCIATED WITH RE-WELDING. EACH TIME THE WELD IS EXTENDED, THERE IS AN "EXTEND WELD" WHICH CAN BE SET AS A FAULT OR ALERT. ALSO, THERE IS A FAULT CONDITION ASSOCIATED WITH EXCESSIVE RE-WELDS - EXCESSIVE EXTEND WELD LIMIT (0-99) THAT CAN BE SET UP TO DETECT IF THE CONTROL PERFORMS A HIGH RATE OF EXTENDED WELDS.

THE FOLLOWING IS AN EXAMPLE OF AN EXTEND FUNCTION IN A WELD SCHEDULE:

30	WELD 20 MS. 5000 AMPS
75	EXTEND UNTIL NO INITIATE

NOTE:

IF THE WELD INITIATE INPUT IS DROPPED BEFORE FUNCTION #75 EXTEND UNTIL NO INITIATE IS EXECUTED IN THE WELD SCHEDULE, A WELD INITIATE NOT PRESENT FAULT WILL OCCUR AND ONLY 20 CYCLES OF WELD TIME WILL BE EXECUTED. OTHERWISE, THE WELD TIME WOULD BE EXTENDED INDEFINITELY UNTIL THE WELD INITIATE INPUT IS REMOVED. THIS EXAMPLE IS HOW A SEAM WELD IS ACCOMPLISHED.

SPECIAL FUNCTIONS

Special functions are used to either create special conditions inside the welding schedule, set local schedule features that over-ride global setup parameters or to chain multiple weld schedules together.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
11	**MEASURE HIGH FORCE NNNN TIME =NNNN MS**	This is a special function used in force feedback monitoring. MEASURE HIGH FORCE sets the maximum value on the force graph scale. Where HIGH FORCE value “**nnn”**, is set within range 0-9999. In a **non-forging application,** HIGH FORCE is the highest weld force of all stacks. Where **forge is used,** HIGH FORCE is the highest forge force for the application. **TIME =nnn** is the sampling time of the force signal. Minimum recommended is 100 msec. After this time, an average is calculated and displayed as a ratio of “Force Signal/ Unit of Force”. When using a DEP 300s this can be viewed under Display Mode ↳ Hardware Status. On ***RAFT™*** Gateway this is viewed via the Update tab, ex: H=367 This function is typically followed by the Hold function in a weld schedule. ***How to use this function:*** • Replace the weld function in a default schedule with function 11. • Close the gun on a force gauge first, verify the reading against target (highest weld/ forge force), correct any calibration issues if found. • Using an O-scope or Digital Multimeter (set TIME around 3000 msec. for Digital Multimeter to allow stabilization of displayed value), adjust the output level of the force signal amplifier to a value of 8VDC. This step ensures a good resolution of the feedback signal and allows a 2V overhead for thermal expansion at the max force (timer max input level = +10VDC) • Close the gun again on a stack equal in thickness to the average of all stacks used in the application. • The average stack minimizes strain offsets due to differences in thickness between tips and is recommended especially for X-guns. **NOTE:** C-FACTOR LVL FUNCTION SHOULD NOT BE PRESENT IN SCHEDULES DESIGNED FOR MEASURE FORCE.WHEN PRESENT, IT WILL PREVENT THE UPDATE OF THE H/ L RATIOS DISPLAYED IN HARDWARE STATUS (DEP) AND UPDATE TAB ***(RAFT™*** GATEWAY).

FUNC. NO.	FUNCTION NAME	DESCRIPTION
12	**MEASURE LOW FORCE NNNN TIME =NNNN MS**	This function is used in force feedback monitoring. MEASURE LOW FORCE sets the minimum value on the force graph scale. LOW FORCE value “**nnn”,** (range 0-9999) is the lowest welding force for the application. Avoid using tip dress force for LOW force setting. **Reason:** Force signal is graphed during the weld pulse; resolution is enhanced by using the lowest weld force as a minimum vs a much lower tip dress force. **TIME =nnnn**, is the sampling time of the force signal. Minimum recommended 100msec. After this time, an average is calculated and displayed as a ratio of “Force signal/Unit of Force”. When using a DEP 300s this can be viewed under Display Mode ↪ Hardware Status. On ***RAFT™*** Gateway this is viewed via the Update tab, ex: L=368 ***How to use:*** • Perform MEASURE HIGH FORCE. • Replace the weld function in a default schedule with function 12. • Close the gun on a force gauge first, verify reading against target (lowest weld force), correct calibration issues if found. • Close the gun again on a stack equal in thickness to the average of all stacks used in the application. • The average stack minimizes strain offsets due to differences in thickness between tips and is recommended especially for X-guns. • Compare the H and L values in Hardware Status (DEP)/ Update tab (***RAFT™*** Gateway). They should be within 10% of each other. • If greater differences are found, check proper alignment and torque of mounting bolt at the strain sensor. • Repeat measure procedure for both High and Low force. Relocate the strain sensor if differences > 10% are still observed.
16	**MOTOR CURR LIMITS HI =NNNN**	Used in a tip dress schedule, this function sets the HIGH and LOW current limits (in mA) for the tip dress motor. **NOTE:** THIS FUNCTION MUST BE INSERTED IN THE SCHEDULE BEFORE FUNCTION #18 (START TIP DRESS MOTOR CHECK).

FUNC. NO.	FUNCTION NAME	DESCRIPTION
17	**TIP DRESS TIME NN SEC BLANK NNNN MS**	Used in a tip dress schedule, this function tells the weld processor to start measuring the current draw of the tip dress motor for the number of seconds specified. In addition, it identifies the blanking time. This is the time period at the start of the function, during which the motor current is not measured. **NOTE:** THIS FUNCTION MUST BE INSERTED IN THE SCHEDULE AFTER FUNCTION #18 (START TIP DRESS MOTOR CHECK). **NOTE:** IF THE WELDING APPLICATION REQUIRES FUNCTION #63 (TURN ON WELD COMPLETE) TO BE USED IN THE TIP DRESS SCHEDULE, FUNCTION #17 MUST BE INSERTED BEFORE FUNCTION #63 TO ENSURE PROPER MEASUREMENT OF THE TIP DRESS MOTOR CURRENT.
18	**START TIP DRESS MOTOR CHECK**	Used in a tip dress schedule, this function tells the weld processor to turn the tip dress motor ON.
19	**STOP TIP DRESS MOTOR CHECK**	Used in a tip dress schedule, this function tells the weld processor to turn the tip dress motor OFF.
62	**REPEAT (AT NEXT FUNCTION)**	This function monitors the status of the Weld initiate input bit. When the last function in the weld schedule is complete, the weld processor checks the status of the Weld initiate input bit. If the bit is HIGH, the weld processor will repeat the weld schedule, starting at the first line following function #62. When the last function is again complete, the weld processor checks the status of the Weld initiate input bit. If the bit is still HIGH, the weld processor repeats the weld schedule again, starting at the first line following function #62. This repeat loop will continue until the Weld initiate input bit goes LOW. **NOTE:** THIS FUNCTION SHOULD BE PLACED IN THE WELD SCHEDULE BEFORE THE SQUEEZE FUNCTION. **NOTE:** REPEAT AND EXTEND FUNCTIONS ARE MUTUALLY EXCLUSIVE. DO NOT USE THE REPEAT FUNCTION WITH ANY EXTEND FUNCTION IN A WELD SCHEDULE.
76	**SEC. CURR LIMITS: HI=NNNN0 LOW=NNNN0**	This function assigns a static HI / LOW current limit window in the “local” weld schedule only. This function overrides the “global” HI / LOW CURRENT LIMIT WINDOW parameters described in Chapter 6: Faults and Setup Parameters.
81	**TRANSFORMER TURNS RATIO NNN :1**	This function tells the weld 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). This function assigns the transformer turns ratio in the “local” weld schedule only. It overrides the “global” transformer turns ratio parameters described in Chapter 6: Faults and Setup Parameters.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
82	**LINEAR STEPPER #NN ASSIGNED (0 = OFF)**	This function assigns the linear stepper 1-10 to a weld schedule. This function must be inserted at the start of the weld schedule before the weld function. If the value is programmed as "00", then there are no steppers assigned to the weld schedule.
85	**PROCESS WELD FAULTS**	This function allows a one-cycle delay in the weld schedule for the weld processor to identify any fault conditions, which may have been generated thus far in the weld 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 and before it activates the WELD COMPLETE output. **NOTE:** THIS FUNCTION MUST BE INSERTED AFTER THE MAIN WELD FUNCTION (#20 OR #30) IN THE WELD SCHEDULE. IF IT IS INSERTED PRIOR TO THE WELD FUNCTION, ALL ZEROS WILL BE REPORTED IN THE WELD DATA MENU. **NOTE:** THIS FUNCTION ONLY PROCESSES THE WELD DATA AND SETS THE FAULT BITS. THE FAULT AND ALERT OUTPUTS ARE NOT TURNED ON UNTIL THE END OF THE SCHEDULE. **NOTE:** THE WELD PROCESSOR WILL EXECUTE THIS FUNCTION ONLY ONCE DURING THE WELD SCHEDULE. IF THE FUNCTION APPEARS IN MORE THAN ONE LOCATION IN THE SCHEDULE, THE FIRST OCCURRENCE WILL BE EXECUTED AND ALL OTHERS WILL BE IGNORED.
86	**VERIFY CYLINDER #N IS OUT OF RETRACT**	This function is inserted at the beginning of the weld schedule. it checks the status of the mapped Retract Valve output bit. A HIGH bit indicates the gun is out of retraction (closed) and it is OK to proceed with the weld schedule. A LOW bit indicates the gun is in retraction (open). When this occurs, a RETRACT PILOT FAULT is generated and the weld schedule is immediately terminated.
90	**SET SPC OFFSET TO NN**	This function assigns the bin number (0-99) for SPC indexing. Bin # 99 is the last usable bin. If the control reaches bin # 99 and is still collecting data, the 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. See Chapter 9: Advanced Topics for more information.
91	**SEND ALL SAMPLES UNTIL NEXT SPC OFFSET**	This function tells the processor to begin collecting weld data for all welds. This should follow function (#87) SET SPC OFFSET 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 to reset the global data collection process. This function overrides the global data collection sample size and Data Collection Sample Frequency setup parameters. The SPC binning routine is a very special feature that allows the user to associate important indexes with welding data. See Chapter 9: Advanced Topics for more information.

FUNC. NO.	FUNCTION NAME	DESCRIPTION
92	**C-FACTOR LIMIT: HI=NNNN LO=NNNN**	This function sets HIGH and LOW C-Factor limits in the weld schedule. See Chapter 9: Advanced Topics for more information.
93	**TIP DRESS ADVANCE: GROUP NN - STEP N**	This function advances all the steppers assigned to the specified GROUP number, to the specified STEP number. For example, if this function was programmed: TIP DRESS ADVANCE: GROUP 02 - STEP 05, every stepper assigned to Group #2 would advance to Step #5. **NOTE:** THIS FUNCTION MUST BE INSERTED INTO A TIP DRESS SCHEDULE, IF THE TIP DRESS SCHEDULE IS USED IN LIEU OF THE TIP DRESS INPUT BIT. **NOTE:** 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 COMPLETES A WELD.
99	**GOTO SEQ#NNN**	This function is an unconditional jump to another weld schedule. It tells the processor to stop the present schedule and continue with the first function in another schedule. This is also known as weld schedule chaining. 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. **NOTE:** CAUTION SHOULD BE OBSERVED WHEN USING THIS FUNCTION. AN INFINITE LOOP OF REPEATEDLY INITIATED WELD SCHEDULES CAN BE INADVERTENTLY CREATED IF THE LAST SCHEDULE IN THE CHAIN IS PROGRAMMED TO RETURN TO THE FIRST SCHEDULE IN THE CHAIN. **NOTE:** IF FUNCTION #85 (PROCESS WELD FAULTS) IS INSERTED BEFORE FUNCTION #99 IN THE ORIGINATING SCHEDULE, ONLY WELD DATA FROM THAT SCHEDULE IS DISPLAYED. IF YOU WISH TO AVERAGE WELD DATA FROM ALL THE SCHEDULES IN THE CHAIN, FUNCTION #85 (PROCESS WELD FAULTS) MUST BE PLACED AFTER FUNCTION #99 IN EACH SCHEDULE.

Chapter 5: PROGRAMMING SCHEDULES

ABOUT WELD SCHEDULES

A weld schedule is a list of commands (or functions), which are used to instruct the weld control to deliver a combination of heat (weld current) and time (weld time) to the weld interface, to create a weld nugget.

Essentially, the weld schedule is a “recipe” and the functions within it are the “ingredients”. Just as it is important to use the right ingredients in the correct measure to make a good culinary dish, it is likewise important to use the right functions (properly programmed and in the correct order) to make a good weld nugget.

THE FOUR BASIC ELEMENTS

FUNCTION	DESCRIPTION
SQUEEZE	Apply pressure (electrode force) to the weld interface
WELD	Deliver weld current to the weld interface
HOLD	Apply wait time after the weld current stops to allow the nugget time to cool.

FUNCTION	DESCRIPTION
WELD COMPLETE	End of schedule.

WELD SCHEDULE FUNCTIONS

FUNCTION TYPE	DESCRIPTION
DELAY	Delay functions are used to cause a wait time to occur for a specified amount of time
WELD	Weld functions are used to provide a specified amount of weld current for a specified length of time
SLOPE	Slope functions are used to provide either a linear increase or decrease in welding current for a specified length of time
I/O	I/O functions are used to verify, change the status of, or wait for certain I/O points to change
EXTENDED	Extended functions are used to extend a particular function within a schedule until certain conditions are met
SPECIAL	Special functions are used to create special conditions within the weld schedule.

For a list of weld schedule functions and descriptions, see“Chapter 4: WELD SCHEDULE FUNCTIONS” ON PAGE 45.

EXAMPLE OF A WELD SCHEDULE

The following is an example of a typical weld schedule. The functions used and how they are programmed, are solely dependent upon the customer's application. Notice that each function has a corresponding number. This allows the user to select functions by number when programming or editing weld schedules.

FUNCTION NO.	FUNCTION NAME
00	START OF SCHEDULE # 1
82	LINEAR STEPPER #1 ASSIGNED (0=OFF)
88	TURN ON ISOLATION CONTACTOR
58	TURN ON WELD IN PROGRESS
92	C-FACTOR LIMIT: HI=999 LO=0
81	TRANSFORMER TURNS RATIO 72:1
1	SQUEEZE 500 MSEC
60	IMPULSE= 232 HEAT MS, 16 COOL MS
30	WELD 1 IMP 9000 AMPS
3	HOLD 83 MSEC
59	TURN OFF WELD IN PROGRESS
63	TURN ON WELD COMPLETE
75	EXTEND UNTIL NO INITIATE
64	TURN OFF WELD COMPLETE
89	TURN OFF ISOLATION CONTACTOR
100	END OF SCHEDULE

NOTE: FUNCTIONS (00) “START OF SCHEDULE” AND (100) “END OF SCHEDULE” ARE PERMANENTLY PROGRAMMED INTO EACH WELD SCHEDULE AND CAN BE NEITHER ADDED NOR DELETED. ALTHOUGH, THEY APPEAR IN THE WELD SCHEDULES, THEY DO NOT APPEAR IN THE INSERT FUNCTION MENU OF ANY PROGRAMMING INTERFACE DEVICE.

HOW TO READ A WELD SCHEDULE

Weld schedules are read starting at the top and moving down, one line at a time. The time it takes the weld control to complete an entire weld schedule can be calculated by adding up all time parameters (cycle and/or milliseconds) programmed within each function throughout the entire schedule.

For example, in the weld schedule above, there is 500 milliseconds of squeeze time, 232 milliseconds of weld time, 16 milliseconds of cool time and 83 milliseconds of hold time. Thus, the time to complete the entire weld schedule is approximately 831 milliseconds (.83 seconds).

PROGRAMMING A WELD SCHEDULE

There are several user interface options available to program a weld schedule. They include the following:

- WTC DEP-300s Data Entry Panel
- WTC ***RAFT***™ Gateway or Weld Gateway Network Software
- Robot Teach Pendant (via WTC's built-in web server)
- Touch Screen (HMI) Devices (via WTC's built-in web server)

In this manual, the DEP-300s data entry panel is used in all programming instructions

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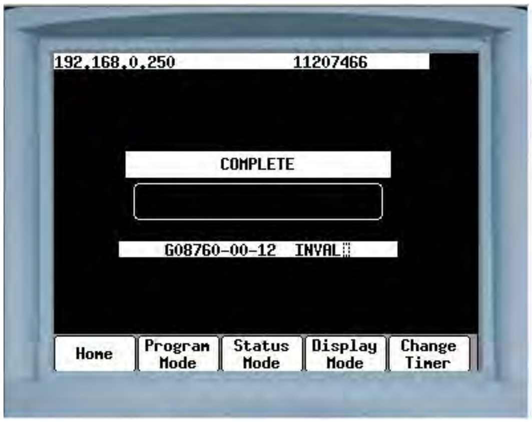
INSERT A FUNCTION INTO A WELD SCHEDULE

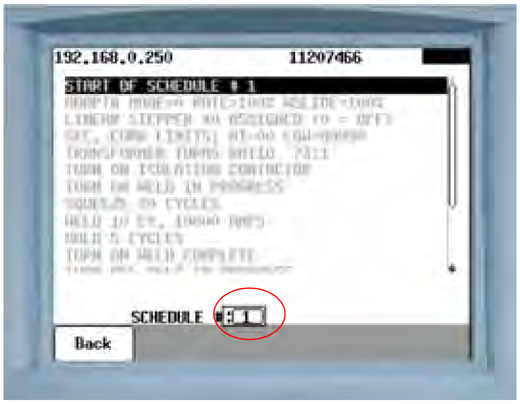
Perform the following steps on the DEP-300s to insert a function into a weld schedule:



① Press B F2 Program Mode.

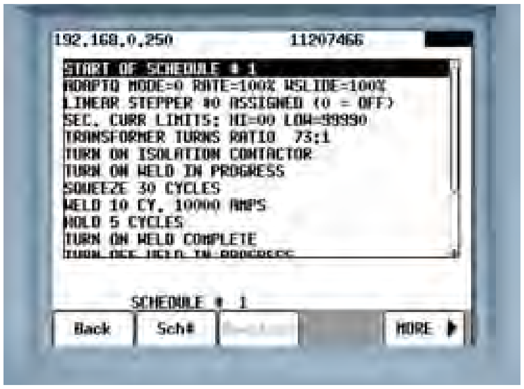
② Press B F2 Review Schedule.

③ Press B F2 Sch#.



④ Enter  Schedule Number.

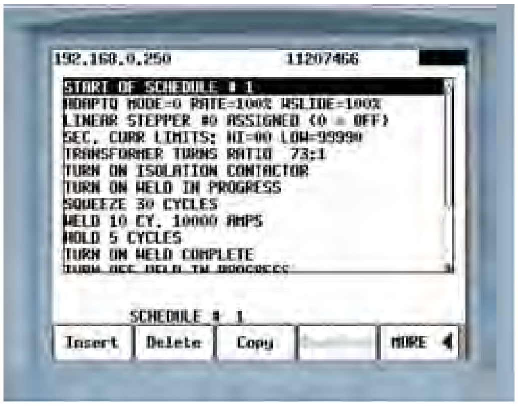
⑤ Press  ENTER.



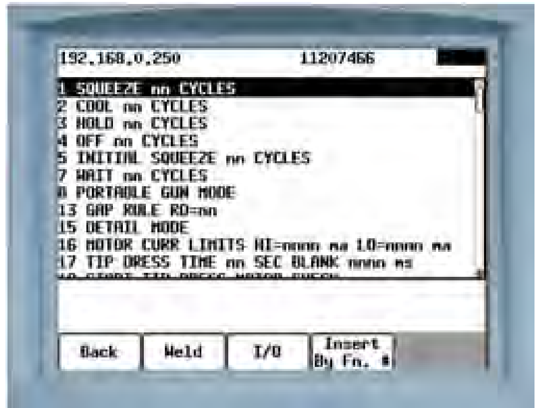
⑥ Press  MORE.

⑦ Press the  or  arrow keys to move the cursor to the line above where the function is to be inserted

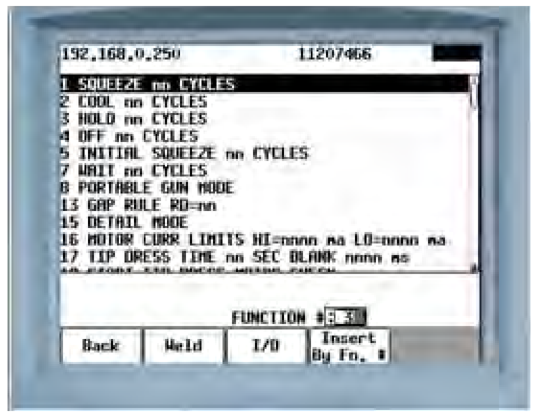
.



⑧ Press  INSERT.



⑨ Press F4 INSERT BY FN. # [Insert by Function Number.].



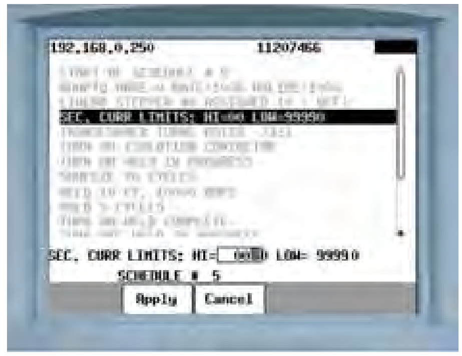
⑩ Press F4. Enter the Function Number.

⑪ Press ENTER ENTER.

⑫ If the function requires parameters to be entered, proceed to step 13. If not, proceed to step 17.

⑬ Enter parameter

⑭ Press ENTER ENTER.



⑮ For functions with two or more parameters, press the RIGHT arrow key to move the cursor to the next parameter box, then repeat steps 13 & 14. When complete, proceed to step 16.

⑯ Press F2 APPLY (F2). [Saves changes to the DEP-300s only.]

⑰ Press F4 DOWNLOAD. [Downloads the changes to the weld processor].

IN THE ***RAFT***™ GATEWAY AND DEP 300S THE ZERO IN THE ONES PLACED IS FIXED. THE TENTHS, HUNDREDTHS AND THOUSANDTHS PLACE ARE PROGRAMMABLE UP TO A MAXIMUM OF 9999. FOR EXAMPLE: ENTER 5O FOR 5OO AMPS.

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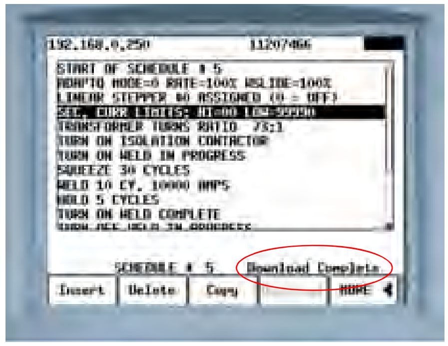
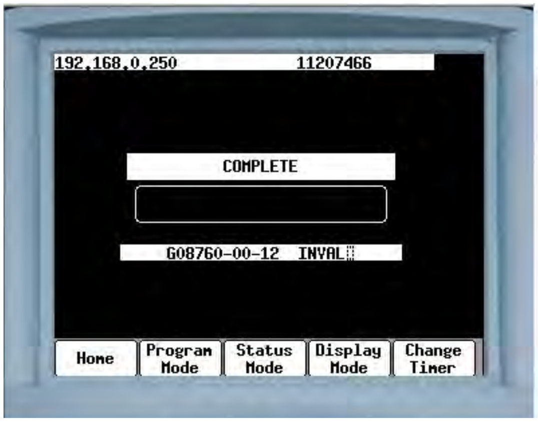
⑱ When complete, a “Download Complete” message will appear.



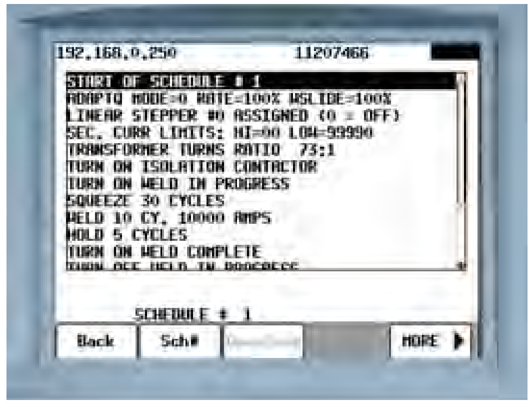
DELETE A FUNCTION FROM A WELD SCHEDULE

PERFORM THE FOLLOWING STEPS ON THE DEP-300S TO DELETE A FUNCTION FROM A WELD SCHEDULE:

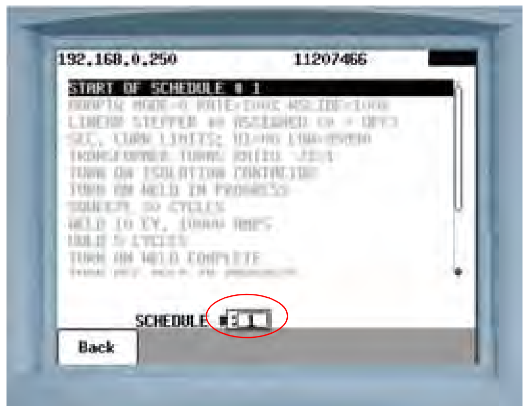


① Press  Program Mode.

② Press  Review Schedule.

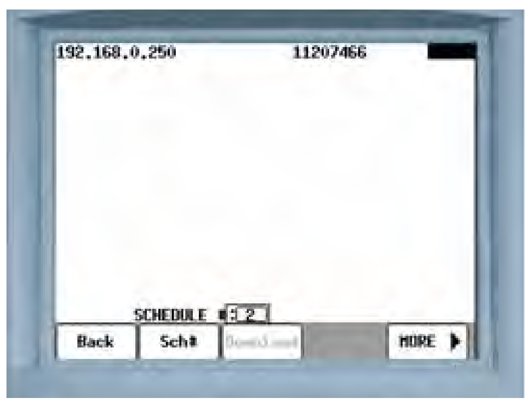


③ Press F2 Sch#.

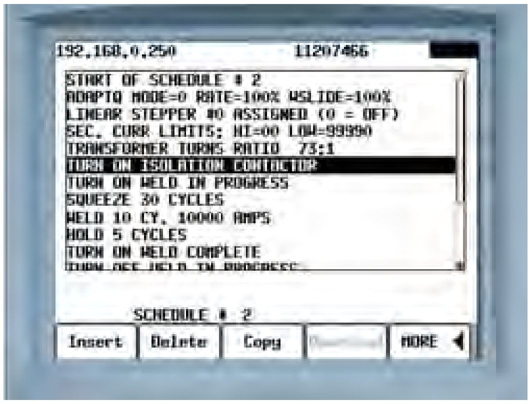


④ Enter Schedule Number.

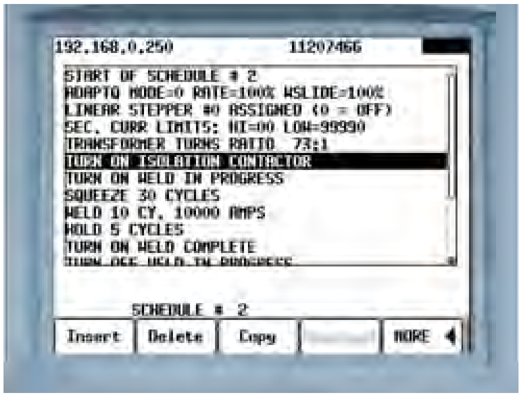
⑤ Press ENTER ENTER.



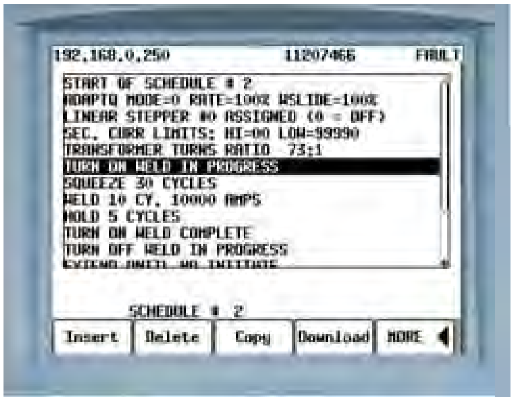
⑥ Press F5 MORE.



⑦ Press the ↑ or ↓ arrow keys to move the cursor onto the function line to be deleted.



⑧ Press F2 DELETE. [The function is immediately deleted from the DEP-300s.].



⑨ Press F4 DOWNLOAD [Downloads the changes to the weld processor. When complete, a "Download Complete" message will appear].

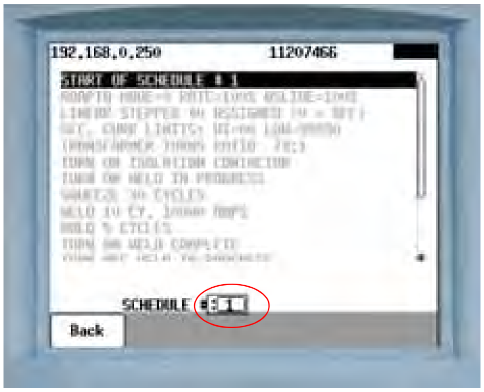
COPYING A WELD SCHEDULE

PERFORM THE FOLLOWING STEPS ON THE DEP-300S TO COPY AN ENTIRE WELD SCHEDULE FROM ONE LOCATION AND PASTE IT INTO ANOTHER:

① Press F2 Program Mode.

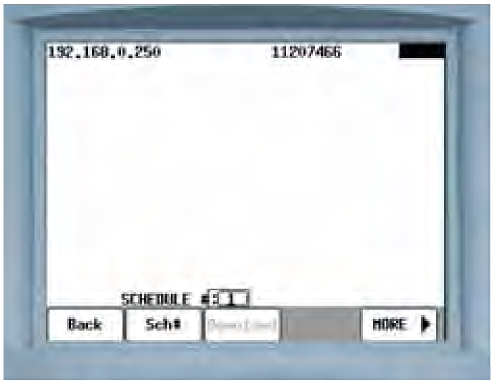
② Press F2 Review Schedule.

③ Press F2 Sch#.



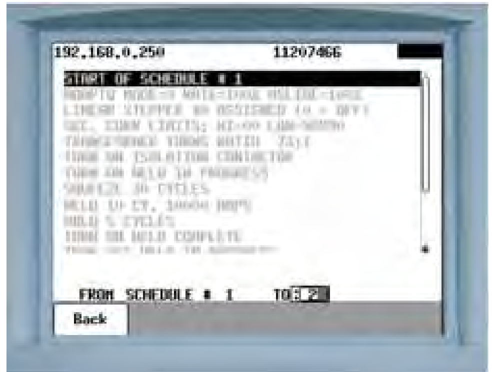
④ Enter Schedule Number 

⑤ Press  ENTER.



⑥ Press  MORE.

⑦ Press  COPY.



⑧ FROM SCHEDULE # (Current Schedule will be displayed) TO [Blank Field] enter the paste to Schedule Number. 

⑨ Press  ENTER.

⑩ The copy is immediately downloaded to the weld processor. When complete, a "Download Complete" message will appear.

WHEN COPYING A WELD SCHEDULE FROM ONE LOCATION TO ANOTHER, ANY EXISTING DATA IN THE PASTE LOCATION WILL BE COMPLETELY OVERWRITTEN AND PERMANENTLY LOST.

SPOT ID PROGRAMMING

The SPOT ID feature is used when setting up welding schedules associated with spot numbers. This allows the user to associate the spot number with programming data used to create the spot and the welding data results of the spot.

An option with this feature is to initiate the weld based on spot numbers instead of schedule numbers. There are 255 weld schedules available for spot selection 1 -255. Spot numbers higher than 255 can be assigned via the “Spot ID system” using binary sequence bits. Individual schedules can also be customized and duplicated.

There is a limitation of 1000 associations of spot numbers to weld schedules. If more than 1000 associations are attempted, the programming device will provide an error message.

If the SPOT ID is assigned, then the weld schedule associated with it will be initiated. If the SPOT ID initiated is not assigned, then an INVALID SEQUENCE SELECTED fault is generated.

The user will be able to select a schedule for view or edit through the use of the spot numbers. When a schedule is chosen for edit based on a spot number, the schedule will be shown along with the other spot numbers which are associated with that schedule.

SPOT SETUP PARAMETERS

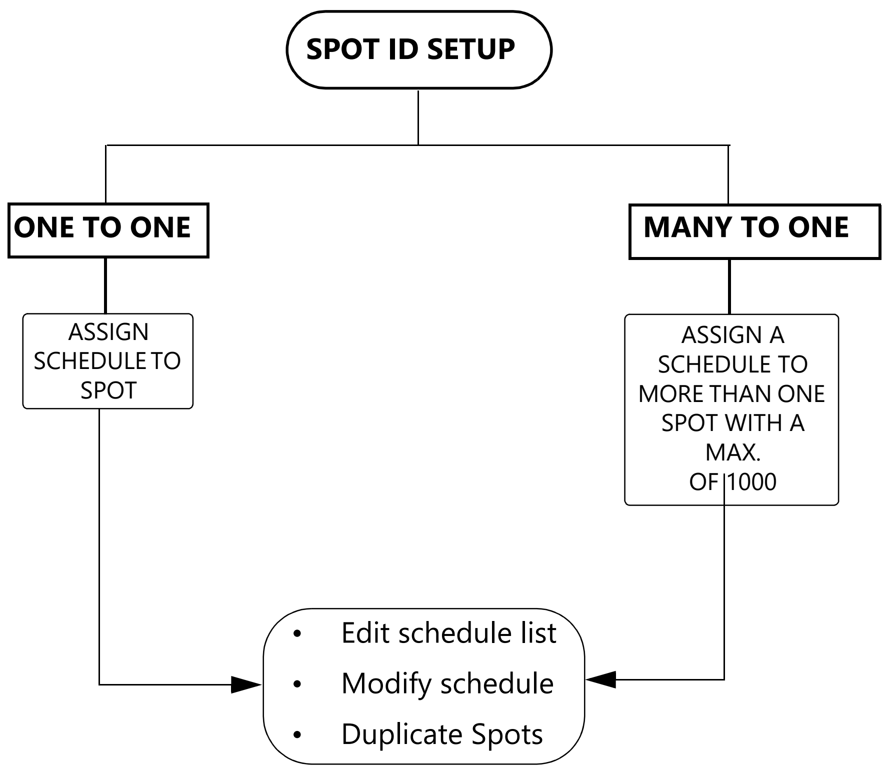
ONE TO ONE (DEFAULT)	One schedule assigned to one spot
MANY TO ONE	One schedule assigned to Many spots

SPOT NO.	Min: 256
	Max: 1073741824

SETUP PROCEDURES

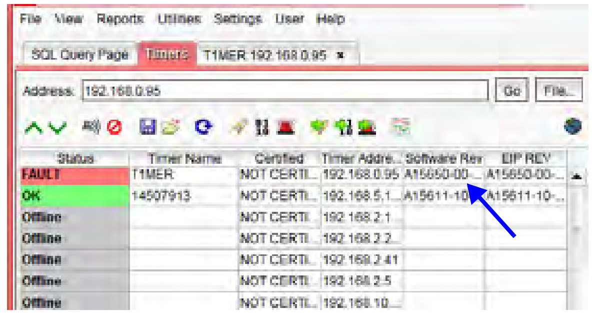
Weld schedules with Spot ID feature can be programed via the ***RAFT***™ Gateway, DEP 300s or the WebView.

At the onset it is important to establish the system configuration by selecting from the two modes available:

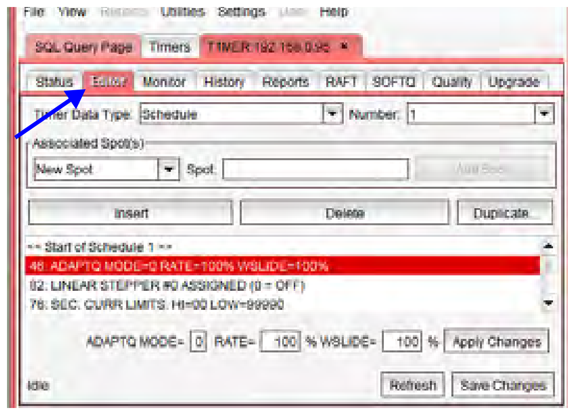


RAFT™ GATEWAY SETUP

SETTING UP A NEW SPOT ID IN ONE TO ONE MODE (DEFAULT)

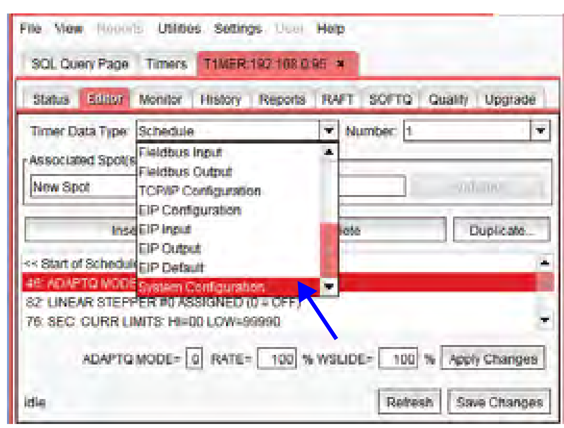


① Launch ***RAFT***™ Gateway and double-click to select the timer .

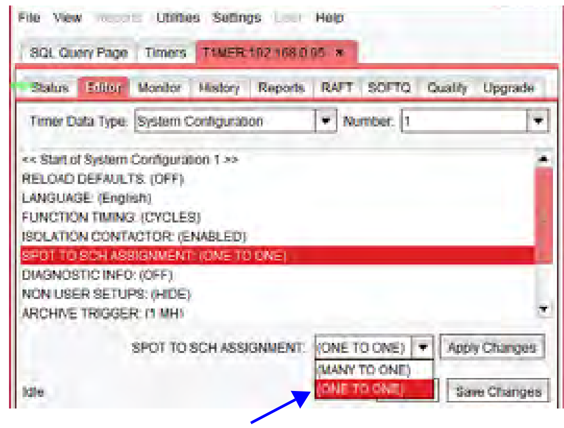


② Select the Editor tab by clicking.

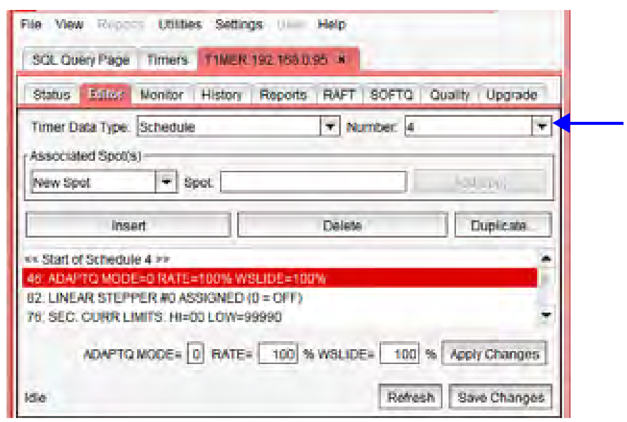
YOUR TIMER SCREEN MAY DISPLAY DIFFERENT INFORMATION DEPENDING ON SOFTWARE INSTALLED. THE SCREEN SHOTS USED IN THE FOLLOWING PROCEDURES ARE FOR ILLUSTRATIVE PURPOSE ONLY.



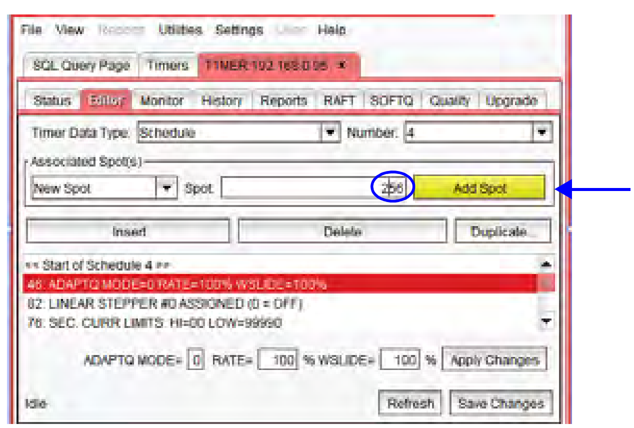
③ From Timer Data Type drop down list select System Configuration.



④ Click on SPOT TO SCH ASSIGNMENT. Then select from one of the two modes available. In our example we will leave it at default mode - ONE TO ONE.



⑤ Go back to SCHEDULE in Timer Data Type select schedule number (4*).



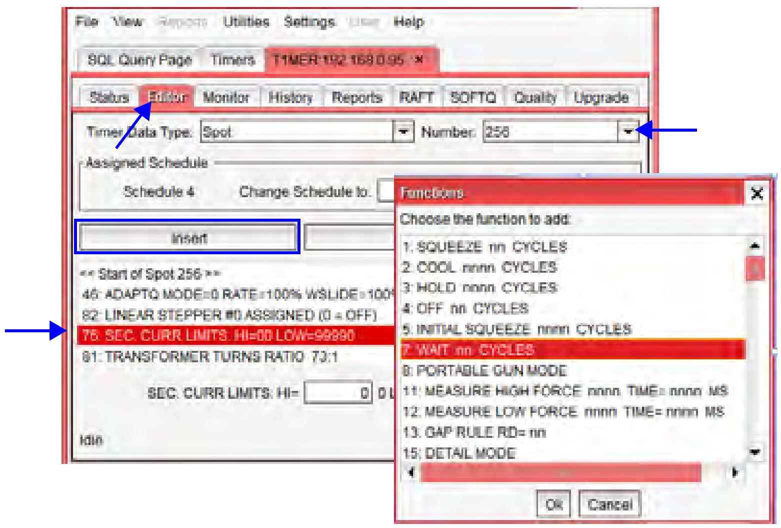
⑥ Enter valid spot number. This field will turn red if a number <256 is entered. The Add Spot button will now turn yellow. Indicating that schedule 4 has been assigned to spot 256.

⑦ Click the Yellow Add Spot button.

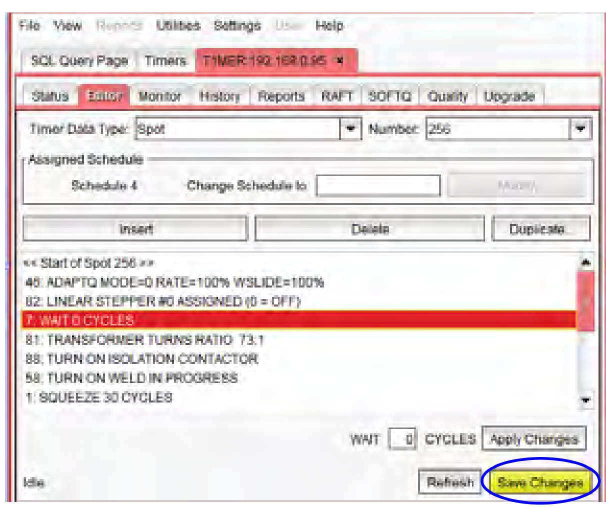
* For exemplary purpose only

EDITING THE SCHEDULE FOR A NEW SPOT

The pre-programmed schedules 1-255 can be individually changed depending on specific spot requirements.



① To edit a schedule select the Spot from the Timer Data Type drop down menu. Then make sure that the right spot number is displayed in the Number field (256 in our example). Navigate to the line in the schedule that has to be edited and click Insert. This opens up a list of available schedule functions in a new window. Select EDGE WELD. Click OK.

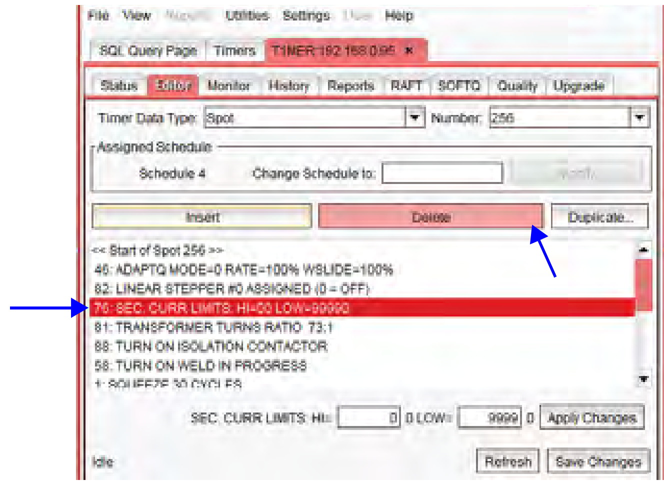


② Click Apply Changes. Then Save Changes.

NOTE:

ONCE A SCHEDULE IS EDITED THE CHANGE IS CARRIED OVER TO ALL SPOTS WITH THE SAME SCHEDULE

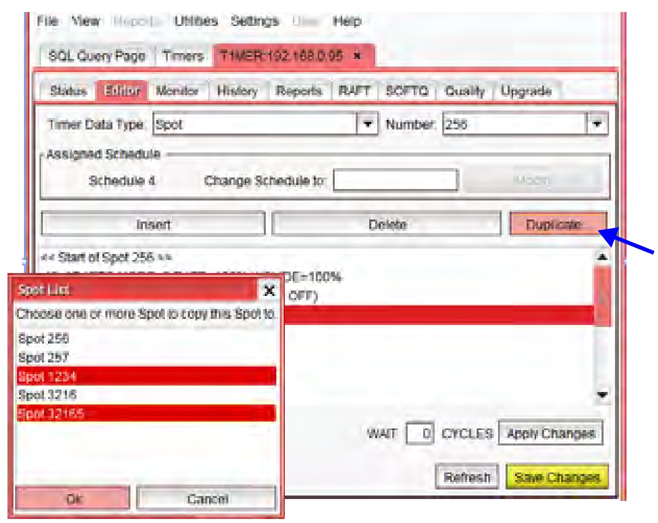
DELETING A FUNCTION FROM THE SCHEDULE



① Select the function line to be deleted and click the delete button.

② The Save Changes button will turn yellow, click to apply.

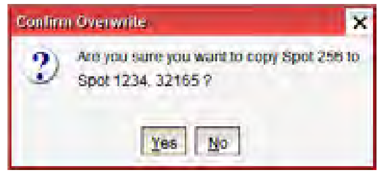
DUPLICATING A SPOT



① To duplicate a Spot click the Duplicate button. This opens up the spots list in a new window. Select the spots and click OK.

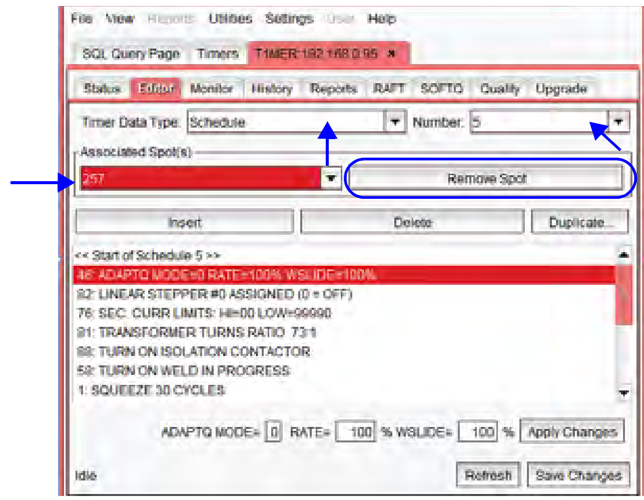
- To select a group of spots listed in order hold Shift + click.

- To select specific spots hold Ctrl + click on the spot. Example Spots 1234 and 32165 as shown above.

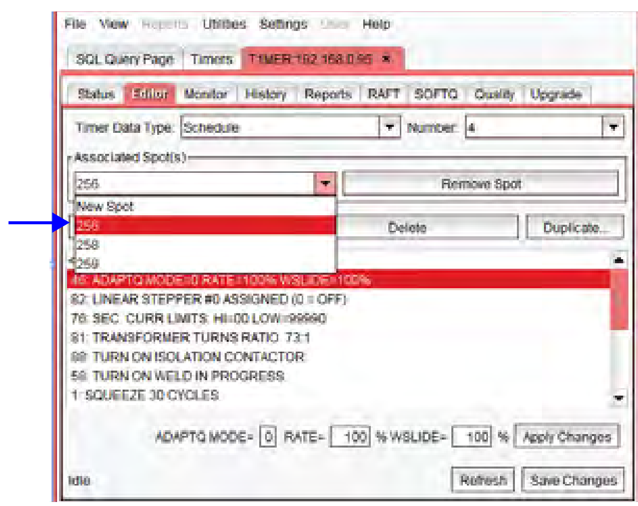


② An alert is annunciated. Click Yes to confirm.

REMOVING A SPOT ID

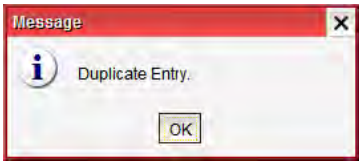


Spots are associated with schedules. Select Schedule from Timer Data Type drop down menu. Then select the schedule number from the list to find the spot associated with the schedule. Click Remove Spot.

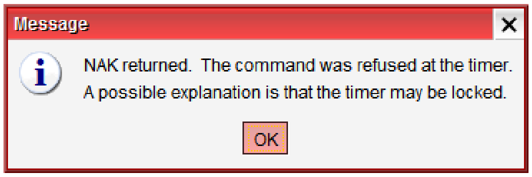


In Many to One Mode, where than one spot is associated with a schedule, select the spot to delete from the Associated Spot(s) drop down menu. Click Remove Spot button. This also removes all changes made to the schedule associated with the particular spot.

POSSIBLE ERROR MESSAGES



1. When the weld program is configured in ONE TO ONE mode a Duplicate Entry error message is generated when an attempt is made to assign a previously assigned schedule to a new spot.

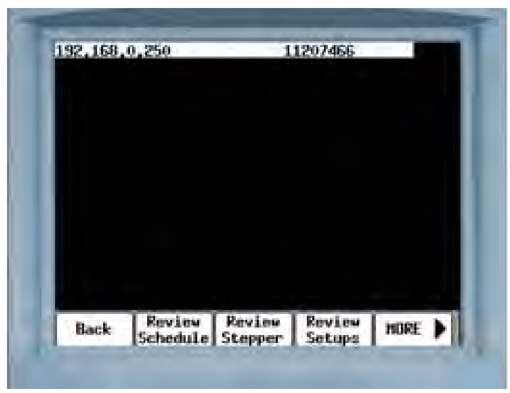


2. When the weld program is configured in MANY TO ONE mode a NAK returned is generated when an attempt is made to associate more that 1000 spots to a single weld schedule.

DEP 300s SETUP

SETTING UP A NEW SPOT ID IN MANY TO ONE MODE

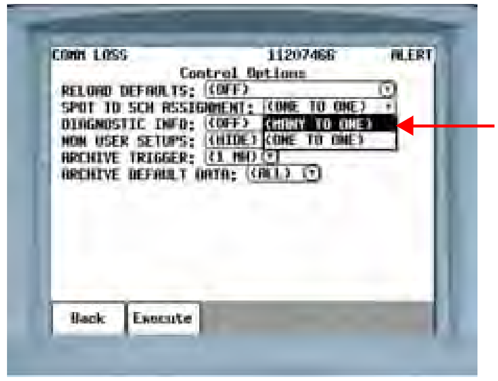
① Press F2 Program Mode.



② Press F5 More.

NOTE: CHECK YOUR DEP 300S COMMUNICATION SETTINGS - LOCAL ETHERNET, GLOBAL ETHERNET OR SERIAL BEFORE PROCEEDING.

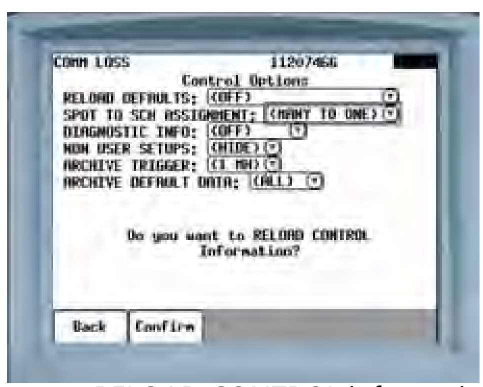
③ Press F4 Reload Options.



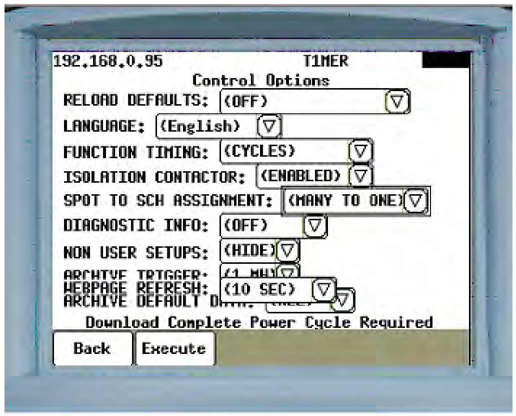
④ Press the ↓ arrow key twice to bring the cursor to SPOT TO SCH ASSIGNMENT. Press ENTER This opens up a drop down box displaying the available modes. Press the ↑ arrow key to select MANY TO ONE.

⑤ Press ENTER .

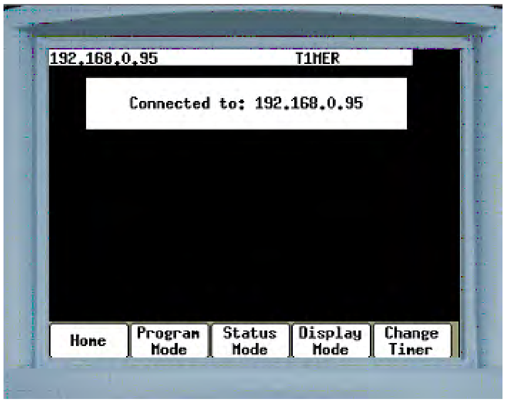
⑥ Press F2 Execute.



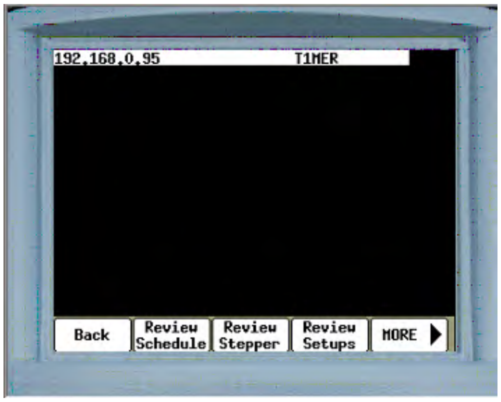
⑦ Do you want to RELOAD CONTROL information will be displayed. Press F2 to confirm.



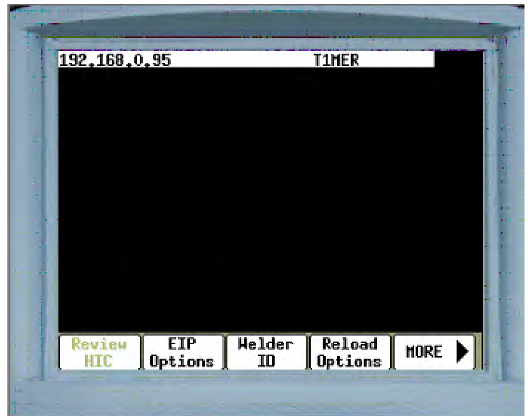
⑧ Press to B F2 Execute and cycle power to the timer confirm the change.



⑨ Press B F2 Program Mode.



⑩ Press E F5 More.

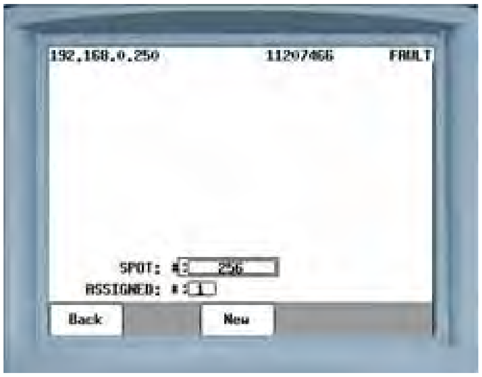


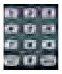
⑪ Press F5 More.

⑫ Press F5 More.

⑬ Press F2 Spots.

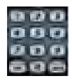
⑭ Press  New.



⑮ Press Enter . Using the number keys  enter spot number (256 in our example).

⑯ Press the  arrow key to move the cursor to the Assigned # field. Enter the schedule number using the number keys

⑰ Then press Enter  Wait for the Download complete message before proceeding.

⑱ Press the  arrow key to move the cursor to the Spot # field. Enter the new spot number using the number keys .

⑲ Then press Enter . Wait for the Download complete message before proceeding.

Repeat Step 16 to add new spots to the selected schedule. Up to a **maximum of 1000 associations to a single schedule are allowed**.

IN MANY TO ONE MODE, THE "WELD ID" DISPLAYED IN THE WELD DATA IS IDENTIFIED BY THE INITIATION. FOR EXAMPLE, IF:
• INITIATION IS BY SCHEDULE THEN THE WELD ID DISPLAYS THE SCHEDULE # AND 0 AS THE SPOT ID #.
• INITIATION IS BY SPOT # THEN THE WELD ID DISPLAYS THE SCHEDULE # AND THE ASSIGNED SPOT #.

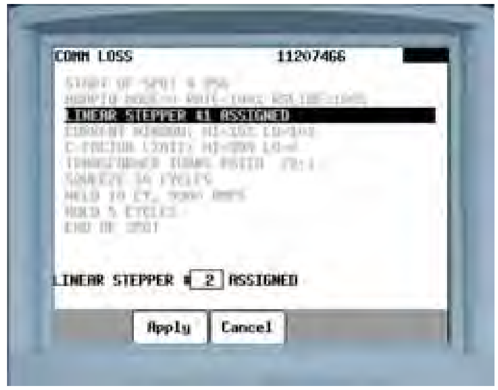
EDITING A SCHEDULE

① Use the or arrow keys to navigate to the line of the Schedule that has to be edited.

② In this example we will edit the Stepper. Press Enter .

③ Using the numbers pad select the number to be assigned to the Linear Stepper #2 is used in our example.

④ Press Enter .



⑤ Press B F2 Apply.

To insert a new function in the schedule use the S ↓ I ↑ arrow keys to scroll to the line that new function will follow and click Insert.

To delete a function in the schedule use the S ↓ I ↑ arrow keys to scroll to the line that has to be deleted and click delete.

DEFAULT WELD SCHEDULES

ROBOT MODE - DEFAULT WELD SCHEDULES

SCHEDULE #	FUNC. #	DESCRIPTION
1-29 and 32 - 255	00	START OF SCHEDULE #N
	46	ADAPTQ MODE= 0 RATE= 100% WSLIDE - 100%
	82	LINEAR STEPPER #0 ASSIGNED (0=0FF)
	76	SEC. CURR LIMITS: HI = 00 LO = 99990
	81	TRANSFORMER TURNS RATIO 73:1
	88	TURN ON ISOLATION CONTACTOR
	58	TURN ON WELD IN PROGRESS
	1	SQUEEZE 30 CYCLES
	30	WELD 10 CYCLES 1000 AMPS
	3	HOLD 5 CYCLES
	63	TURN ON WELD COMPLETE
	59	TURN OFF WELD IN PROGRESS
	75	EXTEND UNTIL NO INITIATE
	64	TURN OFF WELD COMPLETE
	89	TURN OFF ISOLATION CONTACTOR
	100	END OF SCHEDULE

ROBOT MODE - DEFAULT TIP DRESS SCHEDULE

SCHEDULE #	FUNC. #	DESCRIPTION
30 and 31	00	START OF SCHEDULE #N
	58	TURN ON WELD IN PROGRESS
	1	SQUEEZE 30 CYCLES
	59	TURN OFF WELD IN PROGRESS
	63	TURN ON WELD COMPLETE
	3	HOLD 5 CYCLES
	64	TURN OFF WELD COMPLETE
	100	END OF SCHEDULE

MACHINE MODE - DEFAULT WELD SCHEDULE

SCHEDULE #	FUNC. #	DESCRIPTION
1-255	00	START OF SCHEDULE #N
	46	ADAPTQ MODE= 0 RATE= 100% WSLIDE - 100%
	82	LINEAR STEPPER #0 ASSIGNED (0 = OFF)
	76	SEC. CURR LIMITS: HI =00 LOW =99990
	81	TRANSFORMER TURNS RATIO 73:1
	88	TURN ON ISOLATION CONTACTOR
	58	TURN ON WELD IN PROGRESS
	1	SQUEEZE 30 CYCLES
	30	WELD 10 CYCLES 10000 AMPS
	3	HOLD 5 CYCLES
	63	TURN ON WELD COMPLETE
	59	TURN OFF WELD IN PROGRESS
	75	EXTEND UNTIL NO INITIATE
	64	TURN OFF WELD COMPLETE
	89	TURN OFF ISOLATION CONTACTOR
	100	END OF SCHEDULE

Chapter 6: FAULTS AND SETUP PARAMETERS

During the execution of a weld schedule there may be certain events relevant to the weld control that generate Faults/Alerts. These condition indicators can be viewed on the WTC DEP-300s (Data Entry Panel) or via ***RAFT™*** Gateway status display, which can also be used to edit the programmable faults or setup parameters.

Certain conditions are defined as Faults or Alerts in the setup parameters. The weld control uses code numbers to signal faults and warnings. However, the control's response to the condition is standard:

- When the control detects a Fault condition, it may inhibit welding or disallow initiation of a new schedule until the fault condition is cleared.
- Alert conditions serve more as a warning of a potential problem, or that maintenance may be required.

NOTE: THE MFDC INVERTER PROVIDES FAULT DETECTION, AND GENERATES ADDITIONAL FAULT CONDITIONS. THE INVERTER UPLOADS FAULT CONDITIONS TO THE TIMER UNIT AFTER EACH WELD SEQUENCE.

WTC DEP-300s, portable, hand-held, programming device, can be used to communicate with WTC weld controls through an EtherNet IP network to program and edit faults.

[For detailed information on how to use the DEP-300s refer to User Manual # M-035030].

PROCEDURE TO EDIT A PROGRAMMABLE FAULT OR SETUP PARAMETER:

① Press B F2 Program Mode.

② Press D F4 Review Setups.

③ Press the arrow keys to move the cursor to the fault or parameter line to be edited.

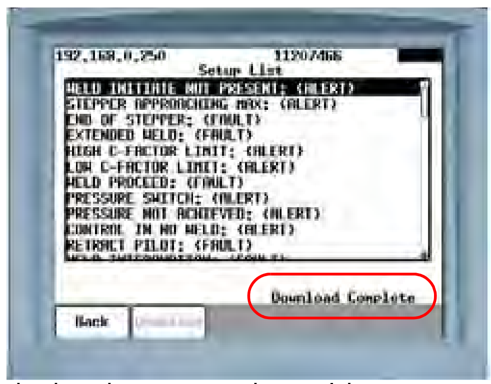
④ Press ENTER.

⑤ Press the arrow keys to select a fault severity option or enter the required parameter.

⑥ Press ENTER.

⑦ Press APPLY. [Saves changes to the DEP-300s only].

⑧ Press 8 F2 DOWNLOAD.



⑨ Downloads the changes to the weld processor. When complete, a **"Download Complete"** message will appear.

FAULT SEVERITY

The user can set the severity of the programmable faults. The severity option tells the weld processor how to respond when a fault condition is detected. Conversely, the severity of non-programmable faults are fixed and cannot be changed. See "Non-Programmable (Hidden) Faults" on page 122

FAULT	When a fault condition is detected by the weld processor, the Fault bit will go HIGH and the No Fault bit will go LOW. Fault conditions generally (with a few exceptions) inhibit the initiation of a weld schedule. A fault condition is remembered by the weld processor when power is re-cycled on the weld control cabinet.
ALERT	When an alert condition is detected by the weld processor, the Alert bit will go HIGH and the No Alert bit will go LOW. Alert conditions generally do not inhibit the initiation or execution of a weld schedule.
NONE	When a fault condition is detected, the weld processor still logs the fault, but inhibits the Fault or Alert bits from turning on (HIGH). This condition will not inhibit the initiation of a weld schedule.

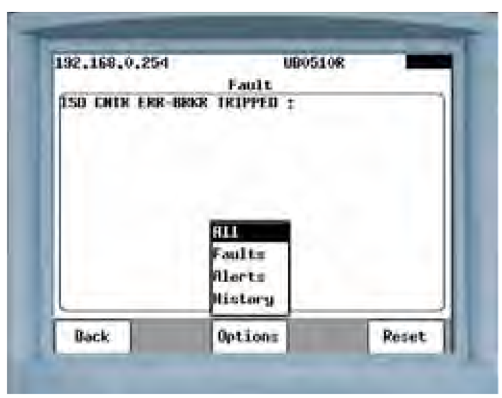
FAULT RESET

Faults can be reset by either pressing the Reset (F5) button on the Fault Status Menu in the DEP-300s or turning the Fault Reset input bit HIGH. Perform the following steps to reset faults via the DEP-300s

① Press  Status Mode.

② Press F2 Fault.

③ Press F5 Reset.



④ Press F3 Options to filter what is viewed on the Fault Status Menu.

⑤ Press the ↑ ↓ arrow keys to move the cursor over the desired filter option.

⑥ Press ENTER Enter.

PROGRAMMABLE FAULTS

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
WELD INITIATE NOT PRESENT **[INT]**	FAULT/ALERT	ALERT ERROR CODE: 1	Occurs when: 1. Function #61 (ABORT IF NO INITIATE FOR nnnn CYCLES) is used in the weld schedule and the Weld initiate bit goes LOW within the amount of time programmed in the function. 2. Function #50 (TURN WELD COMPLETE) is used in the weld schedule and the Weld initiate bit goes LOW before function #50 is executed.	1. This is a pre-weld check. Ensure the master controller (i.e. robot, PLC, etc.) is maintaining the Weld initiate bit HIGH during the time function #61 is monitoring the bit. 2. This is a post-weld check. Ensure the master controller i.e. robot, PLC, etc.) is maintaining the Weld initiate bit HIGH until function #60 is executed in the weld schedule.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
STEPPER APPROACHIN G MAX **[SALT]**	FAULT/ ALERT	ALERT ERROR CODE: 4	1. When any one of the 32 steppers has moved to a point in the stepper profile that is on the last step. 2. When the tip dress feature is enabled, and the Remaining Tip Dresses Count has decremented to 0. 3. At the first weld of step 3, or the desig-nated step pro-grammed in the “TipDress Request Step” from the setup parameters. it is an indication to the robot to bring the electrodes for a tip dressing operation	Indicates the final step in the stepper program has begun and End of Stepper is approaching. Perform a tip dress or tip change.
END OF STEPPER **[EOS]**	FAULT/ALERT	FAULT ERROR CODE: 5	Occurs when 1 or more of the 32 steppers has arrived at the last weld of a stepper program. **NOTE:** THE LAST WELD OF STEP 4 IN THE STEPPER PROGRAM, IF THE TIP DRESS FEATURE IS ENABLED AND THE REMAINING TIP DRESSES COUNT HAS DECREMENTED TO 0. **NOTE:** AFTER THIS FAULT IS ANNUNCIATED, THE FIRST 40 WELDS WILL BE AN ALERT. IF THE STEPPER PROGRAM IS NOT RESET BY THE 41ST WELD, IT WILL CHANGE TO A FAULT.	Reset the stepper (using either the external reset input or the stepper display mode). You should also dress or replace the electrode caps.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
EXTENDED WELD	FAULT/ALERT	ALERT ERROR CODE: 14	This fault indicates that the control had to restart the weld schedule due to insufficient secondary current during the weld. Occurs when: 1. Low current limit is set too high. 2. There is an unusual condition in the secondary. 3. 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. 4. If function #94 (EXTEND WELD IF LOW CURRENT/ RAFT FAULT) or #95 (EXTEND WELD IF CURRENT LESS THAN nnnn0) is used in the weld schedule and the extended weld/re weld is successful, an EXTENDED WELD (ALERT) will occur and the weld complete bit will go HIGH. If the extend weld (re-weld) is unsuccessful, both an EXTENDED WELD (ALERT) and a LOW CURRENT LIMIT FAULT will occur and the Weld Complete bit will stay LOW. 5. The Excessive Extend Weld Limit is reached in the Setup Parameters.	1. Re-program the low current limit setup parameter. 2. Check for improper part fit-up, dirty material, worn electrodes, bad kickless cables or shunts, or loose connections in the secondary circuit. 3. Check for loose wiring at the J3 connector on the firing card. 4. Secure the cable that runs between the firing card and the processor. Check for bad connector. Replace as necessary. 5. Ensure proper air pressure is being supplied to the weld gun. 6. If using function #94, see corrective action for LOW CURRENT LIMIT FAULT. 7. If using function #95 ensure the programmed current value is correct for the welding application. 8. Ensure the value programmed into the Excessive Extend Weld Limit in the Setup Parameters is correct for the welding application. **NOTE:** THIS FAULT MUST BE SET TO (ALERT) FOR THE WELD COMPLETE BIT TO GO HIGH AFTER A SUCCESSFUL EXTEND WELD (RE-WELD). OTHERWISE, IF SET TO (FAULT), THE WELD COMPLETE BIT WILL STAY LOW.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
HIGH C-FACTOR LIMIT	FAULT/ALERT	ALERT ERROR CODE: 19	This fault indicates that the actual C-Factor read during the weld exceeded the values programmed in the C-Factor function #97 (C-FACTOR LIMIT: HI=nnnn LO=nnnn). This can be caused by: 1. Unusual conditions in the secondary. 2. The High C-factor limit was programmed too low.	1. Ensure the “HI” value programmed into function #97 is correct for the welding application. 2. High C-Factor Limit usually indicates current shunting is occurring in the secondary circuit. Typically this is caused by a build-up of expulsion slag across the gun pinch-point, the part shorting to the electrode arms or shorting caused by broken leaf shunts. See Chapter 9: Advanced Topics for more information.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
LOW C-FACTOR LIMIT	FAULT/ALERT	ALERT ERROR CODE: 19	This fault indicates that the C-Factor read during the weld part of the schedule fell below the value programmed in function #92 (C-FACTOR LIMIT: HI= nnnn LO= nnnn) This is caused by: 1. Unusual conditions in the secondary. 2. The Low C-Factor limit was programmed too high. 3. Tips closing too slowly, due to dirty or poorly lubricated cylinder.	1. Check for worn cables, loose connections, low air pressure or other causes of decreased secondary current. 2. If water-cooled cables are used (braided copper inside rubber jacket), the frayed or open cable may not be externally visible and the cable resistance will need to be checked with a Micro Ohm Meter. See Chapter 9: Advanced Topics for more information. 3. Ensure the "LO" value programmed into function #92 is correct for the welding application. 4. Lower C-Factor Limit. 5. Check for sticking gun cylinder.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
WELD PROCEED	FAULT/ALERT ERROR CODE: 1	ALERT	1. This fault is generated if the WELD PROCEED input does not become active within the alloted time specified in function #70 (WAIT FOR WELD PROCEED). 2. If the weld initiate is removed while the control is waiting for the function #70. 3. Faulty robot or PLC ladder logic. 4. Loose or incorrect wiring to the input module. 5. Faulty weld processor card. **NOTE:** ALLOWS WELDING CURRENT IF SET AS AN ALERT AND INHIBITS WELDING CURRENT IF SET AT A FAULT**.**	1. Check the ladder logic to verify that the input is being activated. 2. Check for proper I/O designations. Check to make sure all wiring connections are secure. 3. Replace input module if faulty.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
PRESSURE SWITCH	FAULT/ALERT	ALERT ERROR CODE: 1	Occurs when: 1. function #69 (WAIT FOR PRESSURE SWITCH INPUT) is used in the weld schedule and the Weld initiate bit goes LOW before the Pressure Switch bit goes HIGH. 2. function #68 (WAIT NNNN CY/MS FOR PRESSURE SWITCH INPUT) is used in the weld schedule and the Pressure Switch bit does not go HIGH within the amount of time programmed in the function. **NOTE:** ALLOWS WELDING CURRENT IF SET AS AN ALERT AND INHIBITS WELDING CURRENT IF SET AT A FAULT.	1. Check analog feedback circuit for problems. 2. Check for mechanical problems with the weld gun related to air pressure, e.g. water in air lines, pressure regulator set too low, etc. 3. Check sequence initiated. if the pressure select input is not required, remove the function checking the input. 4. If the function is required, check the switch, contact or device providing the input. 5. If the error was caused by the initiates being removed while waiting for the input, check the initiates.
PRESSURE NOT ACHIEVED	FAULT/ALERT	ALERT ERROR CODE: 1	Occurs when function #74 (WAIT nnn MS FOR PRESSURE ACHIEVED) is used in the weld schedule and the programmed pressure is not achieved within the amount of time programmed in the function.	1. Check analog feedback circuit for problems. 2. Check for mechanical problems with the weld gun related to air pressure, e.g. water in air lines, pressure regulator set too low, etc. 3. Increase the time programmed in the function if incorrect to allow for pressure to achieve the set limit.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
CONTROL IN NO WELD	FAULT/ALERT/ NONE	ALERT ERROR CODE: 2	Occurs when the weld control moves from weld mode to no weld mode during a weld schedule. This fault is also generated if the control receives a weld initiate while in No Weld Mode (i.e. the Weld / No Weld bit is LOW). This can be caused by: 1. Robot or PLC ladder logic de-activated the WELD/NO Weld input. 2. Data entry device is programmed in No Weld Mode. 3. Loose or incorrect wiring to the input module. 4. Faulty input module.	1. Check robot or PLC ladder to verify that the input is being held HiGH throughout the schedule. Use the DEP 300s to observe the status of this input. (To navigate to the required screen, Press Status Mode ↱ ↺↕△➪ ↱ ⇉⇞⮌ ⌤◀➪◀▶▽⇤↘ 2. Verify the data entry device is in Weld Mode. 3. Check for proper I/O designations. Check to make sure all wiring connections are secure. 4. Ensure jumper wire is securely connected to J5, Pins 3 and 4, on the CIOM module. This is the Weld / No Weld hard-wired input. if the hard-wired input is not used, the jumper must be installed. 5. Investigate why the master DeviceNet or Ether-Net iP controller (i.e. robot, PLC, etc.) held the Weld / No Weld input bit LOW when the weld sequence initiated. 6. Ensure the weld processor was not manually put into No Weld Mode through the DEP 300s (if used).

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
RETRACT PILOT	FAULT/ALERT	FAULT ERROR CODE: 2	Occurs during the welding sequence when: 1. function #86 (VERIFY CYLINDER #n IS OUT OF RETRACT) is inserted in the weld schedule, and the weld gun moved out of the weld position (Close Retract output bit HIGH) to the retract position (Close Retract output bit LOW) when checked by the weld processor. 2. when the weld gun is in the retract position (full open) and the weld sequence for that gun is initiated (Schedule Pilot input bit is HIGH). **NOTE:** ALLOWS WELDING CURRENT IF SET AS AN ALERT AND INHIBITS WELDING CURRENT IF SET AT A FAULT.	1. Troubleshoot why the retract cylinder is moving to the retract position (full open) during the welding sequence. 2. Press the retract button on the weld gun and verify the gun is out of retract (in the weld position) before initiating the weld sequence.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
WELD INTERRUPTIO N	FAULT/ ALERT	FAULT ERROR CODE: 2	Occurs when: 1. the Weld / No Weld bit goes LOW while the weld control is passing current during the execu-tion of a weld sched-ule. 2. the circuit breaker on the weld cabinet is switched OFF while the weld con-trol is passing cur-rent during the execution of a weld schedule. The fault will appear after the circuit breaker is switched back ON and the weld proces-sor re-initializes. 3. the weld current is interrupted during the weld time.	Ensure weld gun is not opening early. Check for intermittent open connection in the weld tooling (primary or secondary).
LOW LINE VOLTAGE	FAULT/ALERT	FAULT ERROR CODE: 13	Occurs when the AC line voltage drops below a point where the DC power supply on the CIOM-TB module can no longer regulate the +24VDC it supplies to the devices downstream. This fault is monitored continuously. This can be caused by: 1. Overloading of the weld bus. 2. Brown-outs of the power source.	1. Check the line to ensure you have power on all phases. 2. Re-distribute weld bus load. 3. 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 300s)

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
SOFT OVERCURREN T	FAULT/ALERT NONE	FAULT ERROR CODE: 12	Occurs when: 1. the impedance of the secondary circuit creates a current draw that causes the inverter to reach or exceed its maximum output current rating. 2. when the target secondary current programmed into the weld schedule causes the inverter to reach its maximum output current rating. *To determine the maximum target secondary current, multiply the inverter maximum output current rating by the transformer turns ratio. For example, 400A inverter x 50:1 turns ratio = 20,000A max target secondary current. Thus, programming more than 20,000A into the weld schedule may cause a SOFT OVERCURRENT FAULT.* 3. the inverter reaches its maximum IGBT on-time rating before the target secondary current is achieved. Thus, whatever current level is achieved at max IGBT on-time, is what will be delivered to the welding transformer. 4. the weld processor detects the MFDC inverter is passing weld current at a duty cycle that	1. Check to make sure that the current is not exceeding the limits specified in the Setup Parameters. 2. Review the weld requirements and verify the turns ratio is specified correctly in the primary mode. **NOTE:** WHEN THIS FAULT OCCURS, GO TO THE HARDWARE STATUS SCREEN IN THE DEP-300S BY PRESSING THE DISPLAY MODE (F4) KEY. THE HARDWARE STATUS SCREEN WILL PROVIDE MORE SPECIFIC INFORMATION REGARDING THE NATURE OF THE FAULT. 3.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
CURRENT REGULATION	FAULT/ALERT/ NONE	FAULT ERROR CODE: 12	1. This fault is generated when the inverter reaches its maximum IGBT on-time rating before the target secondary current is achieved. Thus, whatever current level is achieved at max IGBT on-time, is what will be delivered to the welding transformer. 2. DEP 300s shows average current that is more than requested current. 3. Current does not decrease from higher to lower weld current because DC secondary current does not decay quickly enough. This results in: 1. Insufficient current. 2. Missing weld on the part. 3. Open circuit of the welding transformer primary or secondary. This fault may occur in conjunction with System Cooling fault. (See page 128)	1. Decrease weld transformer secondary voltage. 2. Add 1-cycle wait between welds or add a 1/2 cycle impulse function between welds. 3. Verify the primary and secondary cables, isolation contactor and weld transformer for any damage. 4. Ensure that the electrodes and are making contact with pressure and NO insulation material is present on the part between the electrodes. 5. Using a weld meter determine if the secondary current matches the weld control's current reading. • If the secondary resistance is too high reduce the length of the secondary cable and install a cable with a larger diameter. • If the requested current reading is higher than the possible limit of the welding transformer and secondary resistance, correct the discrepancy in the weld schedule or stepper program. Tune the weld transformer tap to a higher ratio. • If the weld control and weld checker readings MATCH and the control continues to show insufficient current and weld expulsion occurs, the

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
HIGH / NO MOTOR CURRENT	FAULT/ALERT/ NONE	FAULT ERROR CODE: 20	1. Occurs when function #16 (MOTOR CURR LIMITS HI =nnnn ma LO =nnnn ma) is used in the weld schedule and the measured tip dress motor current is above the HIGH limit any time during the 8 ms checking period. When this fault occurs, the motor is immediately turned off. 2. Occurs when the measured tip dress motor current is <= 20 ma any time during the 8ms checking period. When this fault occurs, the motor is immediately turned off. **NOTE:** THIS PARAMETER IS USED WITH WELD CONTROLS BUILT WITH THE TIP DRESS MOTOR CONTROL OPTION.	1. When No Motor Current is detected check the wiring to confirm that the motor is properly connected. 2. In case of High Current check the following: • Shorted cables • Jammed Motor • Motor currents set improperly.

FAULT	USER DEFINED PROGRAMMABLE OPTIONS	DEFAULT VALUE	POSSIBLE CAUSES	SOLUTIONS
TIP DRESS	FAULT/ALERT/ NONE	FAULT ERROR CODE: 20	Occurs when function #16 (MOTOR CURR LIMITS HI =nnnn ma LO =nnnn ma) is used in the weld schedule and the measured tip dress motor current is above the value programmed into the LOW limit for less than (1) second of accumulated time. Conversely, this fault will not occur if the measured current remains above the LOW limit for (1) or more seconds of accumulated time.	1. Ensure the High and Low limit thresholds (MOTOR CURR LIMITS HI =nnnn ma LO =nnnn ma) are set correctly. 2. Verify the accumu-lated time limit is set to 1 sec. minimum since any time less than that will cause the fault to be annun-ciated. 3. Check the gun to see if it is closing on the cut-ter.
DUTY CYCLE	FAULT/ ALERT/ OFF	FAULT ERROR CODE: 21	Occurs when the weld processor detects the MFDC inverter is passing weld current at a duty cycle that exceeds the duty cycle rating of the IGBT devices.	1. Decrease the welding current or increase the time between welds. 2. Use an MFDC inverter with a higher current rating at 10% duty cycle.

NON-PROGRAMMABLE (HIDDEN) FAULTS

The following is a list of standard non-programmable faults in the WT6000. Their default values are fixed and cannot be changed. Since these faults are non-programmable, they are hidden from view in the DEP-300s View Setups Menu.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
INVALID SEQUENCE SELECTED	FAULT ERROR CODE: 1	Occurs when the Weld initiate bit goes HIGH and a schedule (sequence) number is selected via the Binary Select bits, which is beyond the range of available schedules.	Ensure the schedule (sequence) number selected via the Binary Select bits is not beyond the range of available schedules. For example, if there are 99 schedules available, selecting schedule 100 or higher via the Binary Select bits will generate an INVALID SEQUENCE SELECTED FAULT, when the Weld initiate bit goes HIGH.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
CONTROL STOP	FAULT ERROR CODE: 3	Occurs when: 1. The Control Stop input bit goes LOW anytime during the initiation of the weld sequence. This bit is normally maintained HIGH. 2. The external or internal wiring (feeding CS1 and CS2) or the input module is open, causing a loss of input voltage to the input. 3. Check the robot or PLC ladder to verify that the control stop input is being held HIGH throughout the weld schedule. 4. The operator or ladder logic removed the CONTROL STOP input. 5. In a single gun welding application when the weld sequence is initiated without the jumper plug inserted into the weld gun 2 connector (2PL).	1. Ensure any manual Control Stop push buttons associated with the control are closed or that the light curtains are not broken. The Control Stop input bit should never go LOW unless a legitimate Control Stop event has occurred. 2. Insert jumper plug into 2PL connector. 3. Ensure jumper wire is securely connected to J5, Pins 6 and 7, on the CIOM module. This is the Control Stop hard-wired input. if the hard-wired input is not used, the jumper must be installed. 4. Investigate why the master DeviceNet or EtherNet iP controller (i.e. robot, PLC, etc.) turned the Control Stop input bit LOW during the weld sequence (e.g. safety gates, light screens, robot E-Stop, master E-stop, etc). 5. Check wiring to verify that 24 VDC is being provided to the CONTROL STOP input.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
HIGH CURRENT LIMIT FAULT	FAULT ERROR CODE: 7	Occurs when: 1. The weld processor detects that the current passed during the weld schedule exceeded the value programmed into the HIGH CURRENT LIMIT WINDOW% in the Setup Parameters. 2. The weld processor detects that the current passed during the weld schedule exceeded the HI value programmed into function #76 (SEC. CURR LIMITS: HI = nnnn0 LOW = nnnn0) in the weld schedule. This can be caused by: • The limit is set too low. • Welder impedance is lower than it was when the current limit was set. The welder may be drawing more current that the originally calculated maximum. • 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. • 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.) • Expulsion caused reduction in the weld resistance. (This may cause the current to exceed the calculated maximum.)	1. Ensure the percentage value programmed into HIGH CURRENT LIMIT WINDOW% in the Setup Parameters is correct for the welding application. 2. Ensure the HI value programmed into function #76 (SEC. CURR LIMITS: HI = nnnn0 LOW = nnnn0) in the weld schedule is correct for the welding application. 3. Ensure the value programmed into TRANSFORMER TURNS RATIO in the Setup Parameters is correct for the welding application. 4. Check for improper installation of either a kickless cable or shunt cable. 5. With a pressure gauge, verify that constant pressure is being maintained. Check for things affecting pressure (such as regulators). 6. Adjust the schedule to reduce expulsion while maintaining sufficient current to provide a good weld. 7. Replace the processor card.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
LOW CURRENT LIMIT FAULT	FAULT ERROR CODE: 7	Occurs when: 1. The weld processor detects that the current passed during the weld schedule was less than the value programmed into the LOW CURRENT LIMIT WINDOW% in the Setup Parameters. 2. The weld processor detects that the current passed during the weld schedule was less than the LOW value programmed into function #76 (SEC. CURR LIMITS: HI = nnnn0) in the weld schedule. 3. When mechanical issues exist in the weld transformer secondary circuit (weld tooling). This can be caused by: • Limit set too high. • Unusual condition in the secondary. • 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.). • Bad jumper cables or leaf shunts. • Bad part fit-up. • Contaminated weld caps. • Insulation from sealer, tape or labels on part. • Gun sticking or not closing properly. • Loose or open secondary diodes in the welding transformer. • Loose or bad primary cables - inspect and correct as necessary.	1. Ensure the percentage value programmed into LOW CURRENT LIMIT WINDOW% in the Setup Parameters is correct for the welding application. 2. Ensure the LOW value programmed into function #76 (SEC. CURR LIMITS: HI = nnnn0 LOW = nnnn0) in the weld schedule is correct for the welding application (if used). 3. Ensure the value programmed into TRANSFORMER TURNS RATIO in the Setup Parameters is correct for the welding application. 4. Look for possible part fit-up and tooling wear issues. 5. 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. 6. Ensure proper air pressure is being supplied to the weld gun. 7. Replace the processor card.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
ISO CNTR OFF WHEN NEEDED	FAULT ERROR CODE: 15	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 finishes the schedule in No Weld and generates this fault condition. if the control is in No Weld mode, it does not generate a fault. **NOTE:** IN THE SITUATION WHERE THERE IS A DRASTIC DROP IN SUPPLY VOLTAGE, FOR EXAMPLE FROM 24VDC TO 15 VDC, THIS FAULT CAN BE ERRONEOUSLY REPORTED WHEN THE SUPPLY VOLTAGE IS RETURNED TO 24 VDC AGAIN. 1. The weld timer controls the isolation contactor, which is driven by a single solid-state relay. The timer unit signal is based on status of the CONTROL STOP and WELD/NO WELD inputs. (Voltage must be present at these inputs to allow the timer unit to open or close the isolation contactor.) 2. For externally-powered controls, an internal control transformer fuse is blown or a bad external power supply is causing the fault. 3. The solid state relay is faulty. 4. 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. 5. Faulty output module.	1. Ensure function #88 (TURN ON ISOLATION CONTACTOR) is in the weld schedule and inserted before the squeeze function. 2. Check if isolation contactor is turning energizing and de-energizing when required: **If YES:** (1) check for an open wire to the aux contact block (2) Ensure wires are connected to the normally closed (N.C.) contacts and (3) ensure aux contact block is not defective. **If NO:** (1) check for an open wire to the isolation contactor coil (2) verify voltage is getting to the coil and (3) ensure isolation contactor coil is not defective (open). 3. Check for defective weld timer. 4. Verify that the isolation contactor coil is receiving 120 VAC. Replace the isolation contactor if the coil is receiving 120 VAC but not closing. Troubleshoot the coil control signal if 120 VAC not present. 5. Verify that the Ready to Weld signal was HiGH (= 1) when required. 6. Check fuses and replace as necessary. 7. Replace relay. 8. Check the wiring diagram that came with your control fro proper i/O designations. Verify that all wiring connections are secure. 9. Replace module if found to be faulty.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
ISO CNTR ERR-BRKR TRIPPED	FAULT ERROR CODE: 15	Occurs when: 1. The weld processor detects the isolation contactor is energized (closed) when it should be de-energized (open). When this fault occurs, the weld processor activates the shunt-trip mechanism on the circuit breaker. This is monitored by the state of the isolation contactor aux contact. This fault will remain until a fault reset is issued even if a power cycle is conducted. 2. A welding condition has caused the control to shunt trip to protect the hardware or a user. **NOTE:** IN THE SITUATION WHERE THERE IS A DRASTIC DROP IN SUPPLY VOLTAGE, FOR EXAMPLE FROM 24VDC TO 15 VDC, THIS FAULT CAN BE ERRONEOUSLY REPORTED WHEN THE SUPPLY VOLTAGE IS RETURNED TO 24 VDC AGAIN.	1. Typically, this fault is caused by a defective auxiliary contact block on the isolation contactor. The contacts can be cleaned by removing the auxiliary block, manually moving the aux contact up and down a few times and then reseting. if this does not resolve the problem, replace the auxiliary contact block. 2. Inspect the isolation contactor for damage. The high current contacts may be frozen shut. if so, replace isolation contactor. 3. Check for defective isolation contactor aux contact module (contacts possible stuck open). Check for loose or open wire connections between the aux contact module and the CIOM module. 4. If the isolation contactor is not defective, the solid state relay on the CIOM module, which drives the isolation contactor coil, may be shorted. Replace CIOM module.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
SYSTEM COOLING	FAULT ERROR CODE: 22	Occurs when the System Cooling bit goes LOW prior to and during the execution of the weld schedule. This bit is normally maintained HIGH. This can be caused by: 1. Defective SCR thermostat. 2. Loose/ incorrect connections to input module or in the circuit. 3. No or insufficient water/air flow. 4. Faulty input module. This bit can be used to set a weld processor fault when a system cooling problem exists somewhere in the welding process. For example, it could be used to indicate a transformer over-temp condition. **NOTE:** THE INVERTER CHILL PLATE TEMPERATURE CAN BE VIEWED IN THE DISPLAY MODE SCREEN OF THE DEP300S.	1. Troubleshoot and find out why the system cooling input is going LOW. Could be a robot / PLC issue logic issue or a legitimate system cooling problem. 2. Replace the thermostat if found defective. 3. Check for proper wiring. 4. Check the water flow, access holes, hoses and filters (if used). 5. Replace the faulty input module.
WELD INTERRUPTION	FAULT ERROR CODE: 3	Occurs when: 1. the Weld / No Weld bit goes LOW while the weld control is passing current during the execution of a weld schedule. 2. the circuit breaker on the weld cabinet is switched OFF while the weld control is passing current during the execution of a weld schedule. The fault will appear after the circuit breaker is switched back ON and the weld processor re-initializes. 3. the weld current is interrupted during the weld time.	1. Check the robot or PLC ladder to verify that the input is being held HIGH throughout the weld schedule. 2. Check for proper I/O designations. Verify that all wiring connections are secure. 3. Replace input module if found defective. 4. Ensure the weld gun is not opening early. 5. Check for intermittent open connection in the weld tooling (primary or secondary). 6. Clear then Fault and cycle power.

<table>
<tr><th>FAULT NAME</th><th>DEFAULT VALUE</th><th>POSSIBLE CAUSE</th><th>SOLUTION</th></tr>
<tr><td>IO</td><td>FAULT

ERROR CODE: 1</td><td>Occurs when:

1. An EtherNet/IP network communication timeout occurs. Once EtherNet/IP communication is re-established, the fault will automatically reset.
2. DeviceNet communication times out. Once DeviceNet communication is re-established, the fault will automatically reset.
3. Customer installed DeviceNet terminations were not properly wired.
4. the weld processor looses communication with any device connected on the SSPI communication link:
• CIOM (Contactor I/O Module)
• AIOM (Analog I/O Module)
• DIOM (Discrete I/O Module)
• GFM (Ground Fault Module)
• MCCM (Multi-Contactor Control Module)

NOTE: PRIOR TO RESETTING THIS FAULT, GO TO THE HARDWARE STATUS SCREEN IN THE DEP-300S BY PRESSING THE DISPLAY MODE (F4) KEY. THE HARDWARE STATUS SCREEN WILL PROVIDE MORE SPECIFIC INFORMATION REGARDING THE NATURE OF THE FAULT.</td><td>1. Determine why EtherNet/DeviceNet communications with the weld timer have been lost. inspect for loose EtherNet/DeviceNet cable connections or defective cable.
2. Ensure all the 15-pin D-sub cables on the SSPI communication link are connected properly and not defective.
3. This link starts at the SSPI port on the weld timer (1CPU) then goes to the -
• CIOM Module (1CIOM)
• The 1st ground fault module (1GFM)
• The 2nd ground fault module (2GFM)
• The discrete I/O module (1IO) and
• Finally to the analog I/O module (1AIOM).
4. Also verify the modules in the communication link are not defective.
5. Check to make sure that the screws attaching the 5-pin Phoenix connector are tight.</td></tr>
<tr><td>INITIATION ON POWER-UP</td><td>FAULT

ERROR CODE: 1</td><td>Occurs when the weld cabinet is powered-up (i.e. circuit breaker is switched ON) and the weld processor detects that one or more Schedule Pilot bit is HIGH. in this condition, a weld schedule WILL NOT initiate.</td><td>Remove Schedule Pilot bit, clear faults and re-initiate the weld schedule.

Ensure the Weld initiate and the Binary Select input bits are set low by the Robot / PLC logic at time of power-up of the weld control cabinet, clear faults and re-initiate weld schedule.</td></tr>
</table>

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
CONTROL TRANSFORMER VOLTAGE	FAULT ERROR CODE: 13	Occurs at power-up only, when an under or over voltage condition exists on the 24VAC secondary tap of the control transformer. The CIOM-TB module monitors the 24VAC secondary tap of the control transformer for either an under or over voltage condition. This ensures the primary of the control transformer is tapped properly for the incoming line voltage. **NOTE:** WHEN AN OVER VOLTAGE IS DETECTED AT POWER-UP, THE CIOM SHUTS DOWN THE 24VDC TO ALL DOWNSTREAM DEVICES IN THE SSPI LINK TO PREVENT DAMAGE. THE OVER VOLTAGE CONDITION MUST BE CORRECTED AND THE CIOM MUST BE RE-STARTED TO CLEAR THIS CONDITION AND RESTORE 24VDC POWER TO THE DEVICES IN THE SSPI LINK.	Inspect control transformer and ensure the primary is properly tapped for the incoming line voltage. **NOTE:** THIS FAULT WILL NOT BE DISPLAYED WHEN AN I/O FAULT IS PRESENT (SEE PAGE 20). THIS WILL OCCUR AS A RESULT OF AN I/O CONFIGURATION ERROR. FOR EXAMPLE WHEN REMOVING THE CADM BOARD AND POWERING UP THE CONTROL WITHOUT THE CADM PRESENT. AN I/O CONFIGURATION ERROR IS POSTED IN THE HARDWARE STATUS.
IGBT SATURATION	FAULT ERROR CODE: 25	Occurs when the weld processor detects an instantaneous over-current event, which exceeds the design rating of the IGBT modules within the inverter assembly. This can be caused by either a short across the welding transformer primary cables or a defective inverter assembly.	Replace shorted primary cables or replace inverter assembly.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
IGBT POWER SUPPLY	FAULT ERROR CODE: 25	Occurs when: 1. There is a loss of power to the IGBT supply board within the inverter assembly. 2. Failed control transformer fuse caused by the isolation Contactor mechanically hang-ing-up in the open state. 3. Loose cable connections at: • CNIG 3/4 @ 1 INV • J2/J3 @ 1 CIOM	1. Check to see if the 1FU and 2FU fuses have blown on the control transformer. if the fuses are blown, using a screwdriver, manually push the isolation contactor in and out a few times and make sure it is not stuck or frozen in the open position. 2. Replace the isolation contac-tor if suspected bad. if the isolation contactor is working, then- 3. Replace the CIOM module. 4. if the CIOM Module is work-ing then - Replace the inverter assembly.
AC LINE PHASE	FAULT ERROR CODE: 13	Occurs when the weld processor detects a line phase is either incorrect or missing. This fault is monitored continuously. This fault may also be accompanied by a Low Line Voltage Fault and/ or Bus Voltage Fault.	Correct power problem or replace / install missing phase.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
BUS VOLTAGE	FAULT ERROR CODE: 25	Occurs when: 1. The weld processor has detected the DC bus within the inverter assembly did not charge to the correct level. 2. The bus voltage drops below 300V (or 42% of the set-up parameter - transformer voltage) while the DC bus is charged or during welding. Should this occur during welding the weld time is truncated and the fault output is energized. This particular weld spot should be marked as suspect or should be re-welded.	1. Check to make sure that the Transformer Voltage Setup Parameters have been entered correctly. 2. Check for loose primary connections at the top or bottom of the circuit breaker or upper level bus fusing connections. 3.  **CAUTION:** Use proper safety lock-out procedures. 4. Improve the current carrying capacity of the welding bus. 5. Change the sequence of welding to reduce the voltage drops. 6. Verify incoming line power is balanced phase to phase (L1-L2, L2-L3, L3-L1). On a 480VAC line, the DC Bus voltage is approximately 700V (incoming power x 1.414) and can be measured at CNIG3. Prior to measuring the DC Bus voltage, verify the multimeter and test leads are rated for high voltage measurement. 7. If the AC line voltage is properly balanced, try resetting the circuit breaker on weld control cabinet. if problem persists, replace defective inverter assembly.
BUS CHARGING	FAULT ERROR CODE: 25	Occurs when the weld processor has detected the DC bus within the inverter assembly did not charge correctly (either too slow or too quickly). This fault is monitored continuously.	Reset circuit breaker on weld control cabinet. Replace inverter assembly if continually re-occurs.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
SECONDARY DIODE	FAULT ERROR CODE: 21	Occurs when: 1. The weld processor has detected a shorted secondary diode within the welding transformer. 2. Missing gate signals from the weld timer. **NOTE:** A MINIMUM OF 5 MS. OF WELD TIME IS REQUIRED TO DETECT THE FAULT	1. Verify the welding transformer diodes are not shorted. if it has been verified the welding transformer secondary diodes are not shorted, then - 2. Replace the weld timer. if replacing the weld timer does not correct the problem, then - 3. Replace the inverter assembly.
SECONDARY CURRENT SENSOR	FAULT ERROR CODE: 20	Occurs at the initiation of a weld sequence, when the weld processor does not detect a proper connection to the secondary current monitoring coil when it should. This fault will only occur when the weld processor is configured to either the (PRI/SEC) or (SEC/SEC) Firing Monitoring Mode in the Setup Parameters.	The secondary current coil is either improperly connected to the weld processor or it is bad. if proper connection has been verified and the fault still persists, replace the coil with a known good one.
OUTPUT GROUND	FAULT ERROR CODE: 21	Occurs when a current imbalance exists between the two output terminals of the inverter assembly.	Identify and correct unidirectional current path to ground between the output of the inverter assembly and the primary of the welding transformer.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
INVERTER OVER TEMPERATURE **or** **TEMPERATURE**	FAULT ERROR CODE: 22	This fault occurs when the timer senses a chill plate temperature of more than 60° C for an Air Cooled inverter or 70° C for a Water cooled inverter. To verify the real time temperature use the “Hardware Status Screen” of the timer and look for “CHILL PLATE TEMPERATURE”. If the fault is displayed during normal operation, the cooling system is unable to remove heat fast enough to protect the SCR/ Diodes and IGBTs. Often this is because the inverter is passing too much current in a short amount of time or the cooling system is not functioning properly.	1. **WATER COOLED INVERTER:** Verify proper cooling water temperature and flow. Ensure the cooling water inlet temperature is < 95° F (35° C). See “Water Cooling Requirements” on page 13 2. **AIR COOLED INVERTER:** Verify proper fan operation and cleanliness of the air fins. Ensure the ambient air temperature around the weld cabinet does not exceed 104° F (40° C). See “Air Cooling Requirements” on page 13 3. Slow down the speed of welding (number of welds per minute). 4. Reduce welding current. 5. Reduce welding time (and/or fewer weld pulses). 6. Reduce the ambient temperature around the inverter or supply cooler water temperature. 7. Select a higher tap setting (turns ratio) for the welding transformer (i.e. reduces the primary current for the same secondary current)
INVERTER SYSTEM FAILURE	FAULT ERROR CODE: 25	Occurs when: 1. A hardware failure is detected within the inverter assembly or weld processor module. 2. The weld processor is unable to read the resistor that tell it what size inverter it is connected to. The resistor is located within the inverter assembly and is either open, missing or an unrecognizable value.	Replace inverter assembly and weld processor module.

FAULT NAME	DEFAULT VALUE	POSSIBLE CAUSE	SOLUTION
POWER FAILURE	FAULT	Occurs when there is a detection of a bad circuit and 24V power source is being supplied power below 18V.	Verify the cause of power failure external to the WCU.

PROGRAMMABLE SETUP PARAMETERS

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
RETRACT MODE	The Retract Mode setup parameter determines how the mapped Retract Valve output bit will react when the control receives the mapped Retract Pilot input bit:	**LATCHED:** in Latched mode, a LOW to HIGH transition on the Retract Pilot input bit causes the state of the Retract Valve output bit to latch ON or OFF. **UNLATCHED:** in Unlatched mode, the Retract Valve output bit follows the state of the Retract Pilot input bit.	LATCHED
CYL	The Cylinder setup parameter defines the type of weld gun air cylinder being used:	**AIR-NORMAL:** in Air-Normal mode, the weld tooling uses an air-only cylinder that requires a HIGH Retract Valve output bit to close the gun to the retracted position. **AIR-INVERTED:** in Air-inverted mode, the weld tooling uses an air-only cylinder that requires a LOW Retract Valve output bit to close the gun to the retracted position.	AIR-NORMAL

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
ISOLATION CONTACTOR DELAY (SEC)	When function #89 (TURN OFF ISOLATION CONTACTOR) is used in the weld schedule, this parameter delays the opening of the isolation contactor for the number of seconds programmed. Typically used in robot applications, this parameter reduces wear on the isolation contactor by preventing it from unnecessarily opening and closing during runs of multiple welds. **NOTE:** FUNCTION #65 (ISOLATION CONTACTOR DELAY = NNNN SEC.) OVERRIDES THIS GLOBAL SETUP PARAMETER, WHEN USED LOCALLY IN A WELD SCHEDULE. **NOTE:** SINCE THIS PARAMETER IS SET TO 99 SEC. BY DEFAULT IT IS ENABLED WHEN THE ISOLATION CONTACTOR INPUT IS NOT MAPED.	00 to 99 Sec	10
HIGH CURRENT LIMIT WINDOW (%)	The High Current Limit Window is calculated as a percentage above the target secondary current (base current + stepper boost). This is a dynamic window, which contours with the linear current stepper program in use. **NOTE:** FUNCTION #84 - CURRENT WINDOW: HI=NN% LOW=NN% (WHEN AVAILABLE) OVERRIDES THIS GLOBAL SETUP PARAMETER, WHEN USED LOCALLY IN A WELD SCHED-ULE.	0% to 99%	20%

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
LOW CURRENT LIMIT WINDOW (%)	The Low Current Limit Window is calculated as a percentage below the target secondary current (base current + stepper boost). This is a dynamic window, which contours with the linear current stepper program in use. **NOTE:** FUNCTION #84 - CURRENT WINDOW: HI=NN% LOW=NN% (WHEN AVAILABLE) OVERRIDES THIS GLOBAL SETUP PARAMETER, WHEN USED LOCALLY IN A WELD SCHED-ULE.	0% to 99%	20%
DATA COLLECTION SAMPLE SIZE	This parameter sets a global command, which allows the weld processor (WCU) to sample data for analysis at controlled intervals. The sample size is the number of consecutive welds collected for analysis (per bin). For more information, see "SPC Indexing Capabilities" on page 225	0 to 99	1
DATA COLLECTION SAMPLE FREQUENCY	This parameter sets a global command, which allows the weld processor (WCU) to sample data for analysis at controlled intervals. The sample frequency is the total number of welds, from which the samples are taken from (per bin). For more information, see "SPC Indexing Capabilities" on page 225	1 to 9999	1

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
ANALOG INPUTS	This parameter tells the weld processor what type of analog signal will be sent to the Analog I/O Module (AIOM). Either a Voltage (0-10V) signal or a Current Loop (4-20ma) signal. **NOTE:** THIS PARAMETER IS USED WITH WELD CONTROLS BUILT WITH AN ANALOG PRESSURE CONTROL OPTION.	VOLTAGE / CURRENT LOOP	VOLTAGE
MAXIMUM ANALOG PRESSURE	This parameter sets the maximum pressure limit an analog device can achieve at full output (10V or 20mA). This value can represent any unit of measure (e.g. PSI, BAR, Mpa, etc.) **NOTE:** THIS PARAMETER IS USED WITH WELD CONTROLS BUILT WITH AN ANALOG PRESSURE CONTROL OPTION.	1 to 9999	100
VALVE 1 INITIAL PRESSURE	This parameter sets the initial pressure of the Valve 1 output bit. This value can represent any unit of measure (e.g. PSI, BAR, Mpa, etc.) **NOTE:** THIS PARAMETER IS USED WITH WELD CONTROLS BUILT WITH AN ANALOG PRESSURE CONTROL OPTION.	0 to 9999	5
VALVE 2 INITIAL PRESSURE	This parameter sets the initial pressure of the Valve 2 output bit. This value can represent any unit of measure (e.g. PSI, BAR, Mpa, etc.) **NOTE:** THIS PARAMETER IS USED WITH WELD CONTROLS BUILT WITH AN ANALOG PRESSURE CONTROL OPTION.	0 to 9999	5

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
TRANSFORMER TURNS RATIO	This parameter is the turns ratio for the welding transformer being used. The weld processor uses this value to calculate secondary current during a weld (secondary current = primary current x turns ratio). **NOTE:** THE FUNCTION TRANSFORMER TURNS RATIO SETS LIMITS THAT ARE UNIQUE TO A GIVEN WELD SCHEDULE. THE NEW LIMITS OVERRIDE THE LIMITS PROGRAMMED IN THE SETUP PARAMETERS. THEY APPLY ONLY TO THE WELD SCHEDULE WHERE THEY APPEAR. THEY ALSO TAKE PRIORITY OVER ANY OTHER LIMITS ESTABLISHED. **NOTE:** FUNCTION #8 1 (TRANSFORMER TURNS RATIO NNN:1) OVERRIDES THIS GLOBAL SETUP PARAMETER, WHEN USED LOCALLY IN A WELD SCHEDULE. Caution: **NOTE:** 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.	1 to 256	73
TRANSFORMER RATED DC VOLTAGE	This parameter is the rated DC voltage of the welding transformer. This value can be found on the manufacturer's label affixed to the welding transformer. **NOTE:** IF THE MANUFACTURER'S LABEL IS EITHER INACCESSIBLE OR HAS BEEN REMOVED FROM THE WELDING TRANSFORMER, CONTACT THE MANUFACTURER FOR ASSISTANCE.	300 to 900	678

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
TRANSFORMER RATED FREQUENCY	This parameter is the rated frequency of the welding transformer. This value can be found on the manufacturer's label affixed to the welding transformer. **NOTE:** IT IS CRITICAL THE VALUE PROGRAMMED INTO THIS PARAMETER IS CORRECT. AN INCORRECT VALUE COULD SEND THE TRANSFORMER INTO SATURATION, CAUSING POTENTIAL DAMAGE TO THE TRANSFORMER. IF THE MANUFACTURER'S LABEL IS EITHER INACCESSIBLE OR HAS BEEN REMOVED, CONTACT THE MANUFACTURER FOR ASSISTANCE.	400 to 2000	1000
FIRING / MONITOR MODE	The WT6000 inverter has three firing and monitoring modes. These modes are distinguished by 1. The method in which the current is regulated. 2. The feedback monitoring method used to determine the proper output.	**PRI/PRI:** Primary Current Regulation / Primary Current Monitoring (Default Mode). **PRI/SEC:** Primary Current Regulation / Secondary Current Monitoring. **NOTE:** REQUIRES ADDITIONAL HARDWARE FOR SECONDARY CURRENT FEEDBACK MONITORING. **SEC/SEC:** Secondary Current Regulation / Secondary Current Monitoring. **NOTE:** REQUIRES ADDITIONAL HARDWARE FOR SECONDARY CURRENT REGULATION AND FEEDBACK MONITORING.	PRI/PRI

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
GROUND FAULT LIMIT (milliamps)	This parameter sets the maximum differential current between the two output terminals (H1 and H2) of the inverter assembly. This imbalance is caused by current leaking to ground on one of the legs. The weld processor monitors the current balance between the H1 and H2 terminals. If the differential current exceeds this parameter, a GROUND FAULT is generated.	0 to 9999	5000

SETUP	DESCRIPTION	PROGRAMMABLE OPTIONS	DEFAULT VALUE
SECONDARY COIL mV/Kamp	This parameter provides the weld control with information on the milli-Volts per 1000 AMPS that the Secondary Coil will output. The typical secondary coil outputs 150mV/KAmp. if this value is incorrect, the amount of secondary current displayed in the Weld Status screen on the DEP 300s will not match the actual current in the secondary. Changing this parameter will adjust the secondary current value read by the control. The output current value that is entered into the Secondary Coil setup parameter is specified by the secondary coil that is installed. An external weld checker can also be used to measure the secondary current. if the value read by the control does not match, this parameter can be adjusted. Caution must be used when using this method. The external weld checker should have it's blanking time set to 0 and longer weld times will produce better readings. **NOTE:** THIS SETUP IS ONLY USED WHEN THE FIRING/MONITORING MODE (SEE SETUP PARAMETERS PG 124) IS SET TO PRI/SEC OR SEC/SEC. **NOTE:** SECONDARY CURRENT MONITORING / CONTROL IS SUPPORTED IN SINGLE-CONTACTOR CONTROLS ONLY.	100 to 300	150

Chapter 7: INPUTS AND OUTPUTS

The WT6000 offers flexible I/O that allows the operator to program the I/O map I/O map for discrete, FieldBus I/O or EtherNet communication. For example, if the operator wants to use the input - Weld initiate, he has the option of putting Weld initiate on any of the 0-16 inputs he chooses. The flexible I/O should not be in conflict with another I/O point, this may inhibit the weld control from firing. An example of conflicting I/O would be having the discrete I/O map and the FieldBus I/O programmed differently. If the I/O maps for the discrete I/O and the I/O for the FieldBus map are identical, the FieldBus I/O will take precedence.

I/O DESCRIPTIONS

NOTE:

THE FOLLOWING SECTION DEFINES ALL POSSIBLE I/O. YOUR WELD PROCESSOR MAY NOT PROVIDE ALL OF THIS I/O, BASED ON THE REQUIREMENTS OF YOUR APPLICATION. REFER TO THE DRAWING PACKET PROVIDED FOR YOUR EXACT I/O AVAILABILITY AND DESIGNATIONS.

NOTE:

EACH I/O BIT HAS A TAG NAME ASSIGNED TO IT. THE TAG NAME IS USED TO IDENTIFY THE BIT ON THE DEP-300S I/O STATUS MENU OR ***RAFT™*** GATEWAY MONITOR SCREEN.

PROGRAMMABLE INPUTS:

INPUT BIT NAME	DESCRIPTION
NONE	When the NONE bit is assigned to an input, the input is disabled and not used by the weld processor.
BINARY SELECT (BS) 1, 2, 4, 8, 16, 32, 64, 128	These inputs select the schedule to be initiated (1-255). The schedule is selected by a combination of these inputs. Each input has a weighted value (1, 2, 4, 8, 16, or 32). 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 (INT)	When this bit goes HIGH, the weld processor will initiate the weld schedule selected through the Binary Select inputs.
WELD / NO WELD (WLD)	When this bit is HIGH, the weld control is in WELD MODE. When this bit is LOW, the weld control is in NO WELD MODE.
ISOLATION CONTACTOR SAVER (CSVR)	This input tells the weld processor enable the ISOLATION CONTACTOR DELAY timer. The delay timer holds the isolation contactor closed after a weld schedule is completed, to prevent it from dropping out between welds. If this bit is HIGH at the end of a weld schedule, the weld processor will hold the isolation contactor closed for the amount of time programmed into the ISOLATION CONTACTOR DELAY setup parameter. If this bit is LOW at the end of a weld schedule, the isolation contactor will drop out immediately 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. Caution:  IF THE WELD SCHEDULE CONTAINS FUNCTION ISOLATION DELAY NN SEC, IT OVERRIDES THE ISOLATION CONTACTOR DELAY WHICH WAS PROGRAMMED IN THE SETUP PARAMETERS.
FAULT RESET (FR)	This input allows the control to remotely reset all faults. This input HIGH when the Fault Status illuminated pushbutton in the operator's panel is pressed. When this bit goes HIGH, the weld processor will reset all faults.

INPUT BIT NAME	DESCRIPTION
WELD PROCEED (WP1)	This bit is used to force the weld processor to pause the execution of a weld schedule until the bit goes HIGH or until the wait time has elapsed in function #70. it is used with function #70 (WAIT nnnn MS FOR WELD PROCEED INPUT) and function #71 (WAIT FOR WELD PROCEED).
STEPPER RESET (SR)	When this bit goes HIGH, the weld processor will "globally" reset all 32 stepper programs to Step 1 and Weld Count 0.
STEPPER RESET GROUP 1 / 2 (SRG1, SRG2)	When this bit goes HIGH, the weld processor will reset only the stepper programs assigned to specified Group.
TIP DRESS (TIPD)	When this bit goes HIGH, the weld processor will: 1. Turn the Tip Dress Request output bit LOW 2. Return the stepper program to the 1st weld of step 2. This applies "globally" for all stepper programs.
TIP DRESS GROUP 1 / 2 (TDG1, (TDG2)	When this bit goes HIGH, the weld processor will 1. Turn the Tip Dress Request output bit LOW 2. Return the stepper program to the 1st weld of step 2. This applies to stepper programs assigned to the specified Group only.
STEPPER AUX WELD CNTR RESET (SACR)	When this bit goes HIGH, the weld processor resets the Auxiliary Weld Counter to zero and turns the Aux. Counter at Max output bit LOW.
APP ERR ACKNOWLEDGE (FACK)	The robot turns this bit HIGH to: 1. Send an acknowledgment to the weld processor that it has read the binary fault code from the App Error output bits. 2. Send the next binary fault code to the App Error output bits.
CONTROL STOP (CSTP)	This bit is normally maintained HIGH. When this input goes LOW, the control aborts the present schedule and will not initiate another schedule until the input becomes activated (or goes HIGH). The Isolation Contactor also drops out (to disable weld current) and a Control Stop fault is generated. Attempting to initiate a weld when this input is inactive will activate a Control Stop fault and de-activate the No Fault output.
PRESSURE SWITCH (PS1)	This bit is used to force the weld processor to pause the execution of a weld schedule until the bit goes HIGH or until the wait time in function #68 has elapsed. it is used with function #68 (WAIT nnnn MS FOR PRESSURE SWITCH INPUT) and function #69 (WAIT FOR PRESSURE SWITCH INPUT).

INPUT BIT NAME	DESCRIPTION
SYSTEM COOLING (COOL)	This bit is normally maintained HIGH. When a system cooling problem exists external to the weld control cabinet (i.e. welding transformer, gun, etc.) this bit will go LOW. The weld schedule will initiate if the bit is LOW, but no current will be passed. At the end of the schedule, the weld processor will generate a LOW CURRENT FAULT and SYTEM COOLING FAULT. If this bit goes LOW anytime during the execution of a weld schedule, the weld processor will generate a SYSTEM COOLING FAULT. When function #79 (WAIT nnnn MS FOR SYSTEM COOLING) is used in the weld schedule, the weld processor pauses the execution of the weld schedule until the bit goes HIGH. if the bit does not go HIGH within the amount of time specified, The weld schedule will continue, but no current will be passed. At the end of the schedule, the weld processor will generate a LOW CURRENT FAULT and SYTEM COOLING FAULT.
PROGRAM DISPLAY SECURITY (PSEC)	When this bit is held LOW, only data within the Stepper Status menu can be edited. When this bit is held HIGH, all data can be edited.
HEAT DISPLAY SECURITY (HSEC)	When this bit is held HIGH, only data in the Stepper Status and Heat Display Menus can be edited. When the Heat Display Security and Program Display Security bits are held LOW simultaneously, only data in the Stepper Status, and Network Address menus can be edited.
USER INPUT 1-6 (UI1, UI2, UI3, UI4, UI5, UI6)	Spare user definable input bit. It is used with functions #66 (WAIT nnn CY INP #n TO BE nn (0=OFF 1=ON)) and #67 (WAIT FOR INPUT #nn TO BE nn (0=OFF 1=ON)) in the weld schedule.
RETRACT PILOT 1/2 (RP1, RP2)	This input bit changes the state of Retract Valve 1 output bit. How this output bit react to the input depends on the parameters programmed into the Retract Mode and Cylinder Setup Parameters.

INPUT BIT NAME	DESCRIPTION
SPOT(S) 9 - 30 (256-536870912)	These bits are used to binarily select a weld sequence by spot ID. They are a continuation of the binary sequence select bits (1-255), but handled differently by the weld timer. If the spot ID selected is assigned, then the weld schedule associated with it will be initiated. If the spot ID selected is not assigned, then an INVALID SEQUENCE SELECTED fault is set. **NOTE:** FOR MORE DETAILS ON PROGRAMMING WITH SPOT ID REFER TO Chapter 5: PROGRAMMING SCHEDULES - “SPOT ID PROGRAMMING” ON PAGE 84
PART FINISHED	This input bit allows the tracking of SOFTQ (Quality) exceptions within a given part. When SOFTQ is enabled and the setup parameters are programmed for exception tracking in the SOFTQ PI Envelope, SOFTQ Monitoring and SOFTQ Trending, this input bit can be mapped to trigger an internal counter. This counter begins a part exception count that remains within the high and low transition limits of the SOFTQ setup. The Part Exception buffer will keep a history of the last 64 welds and any associated SOFTQ Faults. This is a global buffer that tracks all welds. This buffer is reset with the high transition of the Part Finished input. At “Turn On Weld Complete” function if the schedule has SOFTQ enabled and a fault is generated, this will set a bit and index the Part Exception buffer. if the number of SOFTQ faults is equal to or exceeds the Setup Parameter “WELD PROCESS STOP LIMIT”, and the “WELD PROCESS STOP” is programmed greater than zero, then the WELD PROCESS STOP output bit will turn ON until fault reset, or a valid Weld initiate is executed.

INPUT BIT NAME	DESCRIPTION
GUN RES CHECK	This input bit is used to assess the gun resistance and annunciate the “WELD PROCESS STOP” fault if resistance falls outside the acceptable range. When this input bit is enabled at TURN ON WELD COMPLETE, the Resistance Average of the weld is checked within the Schedule’s SOFTQ Monitor Resistance Average settings. If the Resistance Average exceeds the fault level limits it will turn on the Weld Process Stop output. **NOTE:** THIS INPUT IGNORES THE “REWELD NON-RAFT” INPUT. **NOTE:** WHEN THE GUN RESISTANCE CHECK INPUT IS ON, THE “PART FINISHED” INPUT & THE SOFTQ EXCEPTIONS COUNTERS ARE IGNORED. THIS WILL RESULT IN ALL SOFTQ FAULTS (EXCEPT GUN RESISTANCE) TO BE REPORTED INDEPENDENT OF THE NUMBER OF SOFTQ EXCEPTIONS IN THE COUNTER.
REWELD NON-RAFT (RWLD)	This input bit allows the robot to reweld bypassing ADAPTQ and SOFTQ. **NOTE:** WHEN USED IN CONJUNCTION WITH GUN RESISTANCE CHECK THIS INPUT IS IGNORED.
WELD ID (WD) 1, 2, 4, 8, 16, 32, 64, 128	These input bits are designed to support the binary configuration for the robot to read SPOT ID associated schedules when the numbers go beyond 6 digits.
TIP DRESS MOTOR ON	This input functions as an external request which is independent of the weld schedule and allows the Robot or PLC to start the tip dress motor.
FORCE MEASURE IN	This bit functions as a robot output before the closing of the weld gun to indicate the start of force signal measurement by the WTC weld control. **NOTE:** THIS FEATURE IS ONLY AVAILABLE IN CONTROLS WITH FORCE MONITORING ENABLED.

LOCAL INPUTS (NON-PROGRAMMABLE)

INPUT BIT NAME	DESCRIPTION
ISOLATION CONTACTOR AUX CONTACT (ISOC)	This input monitors the state of the auxiliary contact on the isolation contactor. A HIGH bit indicates the isolation Contactor is de-energized (open)
CONTROL STOP (CS2)	This bit is normally held HIGH. A LOW bit indicates a Control Stop condition exists.
WELD / NO WELD (NW2)	A HIGH bit indicates the Weld / No Weld switch is in the Weld position.
AUXILLARY COOLING (TS2)	This bit is normally held HIGH. A LOW bit indicates a welding transformer over-temp condition exists.
OVER VOLTAGE (OV)	This bit goes HIGH when an over voltage condition exists on the 24VAC secondary tap of the control transformer. When this bit goes HIGH, the CONTROL TRANSFORMER VOLTAGE fault is set and indicates the primary of the control transformer is not properly tapped for the incoming line voltage. **NOTE:** THE CIOM AUTOMATICALLY TURNS OFF THE 24VDC TO ALL DOWNSTREAM DEVICES ON THE SSPI LINK TO PROTECT THESE DEVICES FROM DAMAGE DUE TO OVER VOLTAGE. DURING AN OVER VOLTAGE CONDITION AT POWER UP, THE LV (LOW VOLTAGE) BIT IS ALSO SET HIGH. THIS OCCURS AS A RESULT OF LOW DC VOLTAGE BEING DETECTED AS THE LARGE ELECTROLYTIC CAPACITOR ON THE CIOM DC SUPPLY IS CHARGING.
UNDER VOLATGE (UV)	This bit goes HIGH when an under voltage condition exists on the 24VAC secondary tap of the control transformer. When this bit goes HIGH, the CONTROL TRANSFORMER VOLTAGE fault is set and indicates the primary of the control transformer is not properly tapped for the incoming line voltage.
LOW VOLTAGE (LV)	This bit goes HIGH when the AC line voltage drops below a point where the DC power supply on the CIOM-TB module can no longer regulate +24VDC. When this bit goes HIGH, the LOW LINE VOLTAGE fault is set

PROGRAMMABLE OUTPUTS

OUTPUT BIT NAME	DESCRIPTION
NONE	When the NONE bit is assigned to an output, the output is disabled and not used by the weld processor.
VALVE 1-6 (V1, V2, V3, V4, V5, V6,)	This bit goes HIGH when function #50 (TURN ON VALVE n) is executed in the weld schedule and goes LOW when function #51 (TURN OFF VALVE n) is executed.
NO FAULT (NFLT)	This bit is normally maintained HIGH and indicates a FAULT condition does not exist. When a FAULT occurs, this bit will go LOW.
NO ALERT (NALT)	This bit is normally maintained HIGH and indicates an ALERT condition does not exist. When an ALERT occurs, this bit will go LOW. Alert conditions are usually less serious than faults and normally serve to warn the operator that maintenance is required.
FAULT (FLT)	This output is normally held LOW, indicating that the control is functioning normally. If the control shuts down as a result of a fault condition, this output bit will go HIGH.
ALERT (ALT)	This bit will go HIGH when an ALERT condition exists.
WELD MODE ON (WMON)	This bit goes HIGH when the weld control is in WELD MODE.
NO WELD (NWM)	This bit goes HIGH when the weld control is in NO WELD MODE.
WELD IN PROGRESS (WIP)	This bit goes HIGH when function #58 (TURN ON WELD IN PROGRESS) is executed in the weld schedule and goes LOW when function #59 (TURN OFF WELD IN PROGRESS) is executed.
WELD COMPLETE (WCPL)	This bit goes HIGH when function #63 (TURN ON WELD COMPLETE) is executed in the weld schedule and goes LOW when function #64 (TURN OFF WELD COMPLETE) is executed.
READY TO WELD (RTW)	This bit goes HIGH when all the following conditions are true: 1. The weld control is in WELD MODE. 2. No fault condition exists. 3. The Control Stop input bit is HIGH. 4. The System Cooling input bit is HIGH.
STEPPERS ARE RESET (SRST)	This bit goes HIGH when all 32 stepper programs are globally reset.
STEPPERS ARE RESET GROUP 1 / 2 (SRG 1, SRG 2)	This bit goes HIGH when the stepper programs assigned to group 1/2 are reset.

OUTPUT BIT NAME	DESCRIPTION
END OF STEPPER (EOS)	The weld control will activate this output when the stepper completes the last weld in the last step. When the tip dress feature is enabled, this bit will go HIGH on the last weld of step 5 in the stepper program, if the Remaining Tip Dresses Count has decremented to 0. This bit will go LOW when either the Stepper Reset, Stepper Reset Group 1 or Stepper Reset Group 2 input bits go HIGH.
END OF STEPPER 1-2 (ESG1, ESG2)	This bit will go HIGH on the last weld of step 5 in the stepper program. This bit will go LOW when either the Stepper Reset or Stepper Reset Group 1/2 input bit goes HIGH
STEPPER APPROACHING MAX (SALT)	When the tip dress feature is enabled, this bit will go HIGH on the 1st weld of the last step in the stepper program, if the Remaining Tip Dresses Count has decremented to 0. This bit will go LOW when either the Stepper Reset, Stepper Reset Group 1 or Stepper Reset Group 2 input bits go HIGH.
STEPPER APPROACHING MAX 1-2 (SAG1, SAG2)	This output will go HIGH when the control reaches the start of the last step in the stepper profile. This bit will go LOW when either the Stepper Reset, Stepper Reset Group 1 or End of Stepper Group 1 input bit goes HIGH.
TIP CHANGE REQUIRED	This bit will go HIGH after the last weld in step 4 of a stepper program, if the Remaining Tip Dress Count (Tip Dresses) has decremented to zero in the Stepper Status Menu. This bit will go LOW when the Stepper Reset input bit goes HIGH. **NOTE:** IF STEP 4 IS PROGRAMMED WITH 0 WELDS, THIS OUTPUT TURNS ON AT THE BEGINNING OF STEP 5.
TIP CHANGE REQUIRED GROUP 1-2 (TCG1, TCG2)	This bit will go HIGH at the end of any stepper program assigned to Group 1/2, if the Remaining Tip Dress Count (Tip Dresses) has decremented to zero in the Stepper Status Menu. This bit will go LOW when either the Stepper Reset or Stepper Reset Group 1 / 2 input bit goes HIGH.
TIP DRESS REQUEST (TDR)	This bit will go HIGH at the first weld of Step 5 in the stepper program, if the Remaining Tip Dresses Count is > 0. it is used as an indicator to the robot that a tip dress is required for the weld caps. This bit will go LOW when 1. The Tip Dress Request, Tip Dress Request Group 1 or Tip Dress Request Group 2 input bits go HIGH. 2. The tip dress schedule is initiated.

OUTPUT BIT NAME	DESCRIPTION
TIP DRESS REQUEST GROUP 1-2 (TDG1, TDG2)	This bit will go HIGH at the first weld of Step 5 in the stepper program, if the Remaining Tip Dresses Count is > 0. it is used as an indicator to the robot that a tip dress is required for the weld caps. This bit will go LOW when: 1. The Tip Dress Request, Tip Dress Request Group 1 or Tip Dress Request Group 2 input bits go HIGH or 2. The tip dress schedule is initiated.
STEPPER AUX COUNTER AT MAX (SACM)	This output bit goes HIGH when the Auxiliary Weld Counter has reached the value programmed in the Aux. Counter Max Counts field in the Stepper Profile.
APP ERROR AVAILABLE (EVAL)	When a fault occurs, this bit goes HIGH to advise the robot to read the binary fault code on the App Error Bit output bits.
APP ERROR BIT (ER1, ER2, ER4, ER8, ER16)	These bits are used by the weld processor to send binary fault codes to the robot.
PRESSURE SELECT (PS1, PS2, PS3, PS4)	During the execution of a weld schedule, the weld processor takes the value programmed in function #54 (TURN ON PRESSURE SELECT) and turns the corresponding binary Pressure Select output bits HIGH. If SET PRESSURE = 0, all four bits (1, 2, 8, 4) are LOW.
USER OUTPUT 1-6 (UO1, UO2, UO3, UO4, UO5, UO6)	This bit goes HIGH when function #52 (TURN ON OUTPUT 1 / 2 / 3/ 4 / 5/ 6) is executed in the weld schedule and goes LOW when function #53 (TURN OFF OUTPUT 11 / 2 / 3/ 4 / 5/ 6) is executed.
RETRACT VALVE 1-2 (RT1, RT2)	The state of this bit changes according to the status of the Retract Valve input bit. How this bits reacts depends on the parameters programmed into the Retract Mode and Cylinder Setup Parameters. **NOTE:** THE RETRACT VALVE OUTPUT TURNS OFF WHEN THE CONTROL STOP IS EXECUTED. THE RETRACT VALVE WILL REMAIN OFF AT POWER UP REGARDLESS OF THE STATE PRIOR TO POWER DOWN.
INVERTED RETRACT VALVE 1-2 (IRT1, IRT2)	The state of this bit changes according to the status of the Retract Pilot 1 input bit. **NOTE:** THIS BIT IS FUNCTIONAL WHEN THE RETRACT PILOT INPUT BIT IS MAPPED. **NOTE:** BOTH RETRACT OUTPUT BITS REMAIN OFF AFTER THE CONTROL IS POWERED UP AND/OR AFTER A CONTROL STOP CONDITION. THE RETRACT INPUT BIT MUST ALWAYS BE TOGGLED AFTER THESE EVENTS TO RETURN THE RETRACT OUTPUT BITS TO THEIR EXPECTED STATES.

OUTPUT BIT NAME	DESCRIPTION
WATER SAVER (WSVR)	This bit goes HIGH when a weld schedule initiates. After the weld schedule is complete, the weld processor starts an internal timer holding the bit HIGH for an additional three minutes. When the timer has ended, the bit goes LOW. **NOTE:** THIS OUTPUT TURNS OFF 3 MINUTES AFTER THE LAST SCHEDULE IS INITIATED. THIS TIME INTERVAL IS FIXED AND NOT PROGRAMMABLE.
FORGE (FRG)	This is the trigger output for force increase during the execution of a weld schedule, see Forge Force outputs on page 154.
GAP (GAP)	This bit goes HIGH when an ADAPTQ GAP FAULT occurs.
ADAPTQ MISMATCH (ADQX)	This output bit goes HIGH when: 1. The Reference weld and R-Measure for the given schedule is indexed. 2. An internal or external reweld was performed
SOFTQ MISMATCH (SFQX)	This out put bit goes HIGH when SOFTQ settings have been turned OFF using ***RAFT***™
RAFT CAPABLE (RAFT)	This bit goes HIGH when both hardware and software to support ***RAFT***™ is detected.
ADAPTQ ENABLED (ADPQ)	This output bit goes HIGH when a schedule is welded in the adaptive mode.
SOFTQ ENABLED (SFTQ)	This output bit goes HIGH when a schedule is welded with SOFTQ monitoring is available for the schedule.
TIP DRESS MOTOR RUNNING	This output goes HIGH as a handshake acknowledgment of the TIP DRESS MOTOR ON input.
FORGE FORCE (FF1, FF2, FF4, FF8, FF16, FF32, FF64, FF128, FF256, FF512, FF1024, FF2048, FF4096, FF8192)	Binary outputs used to send the new force target value to the robot at the beginning of a weld schedule. The robot starts the weld schedule with a pre-programmed force, then changes it to this new target when the weld timer outputs the FORGE bit.
FORCE MEASURE OUT (FRCO)	This output is an acknowledge of the Force Measure in input and functions as a handshake signal to the robot that the force measure has been initiated.

LOCAL OUTPUTS (NON-PROGRAMMABLE)

OUTPUT BIT NAME	DESCRIPTION
ISOLATION CONTACTOR (ISOC)	A HIGH bit energizes the isolation contactor.
CIRCUIT BREAKER SHUNT TRIP (ST)	A HIGH bit energizes the circuit breaker shunt-trip mechanism

I/O STATUS

TO NAVIGATE TO THE I/O STATUS MENU, PERFORM THE FOLLOWING STEPS ON THE DEP-300S:

① Press Status Mode C F3.

② Press More E F5.

③ Press I/O Status B F2.

④ Press Page 2 E F5 to view more bits (if applicable).

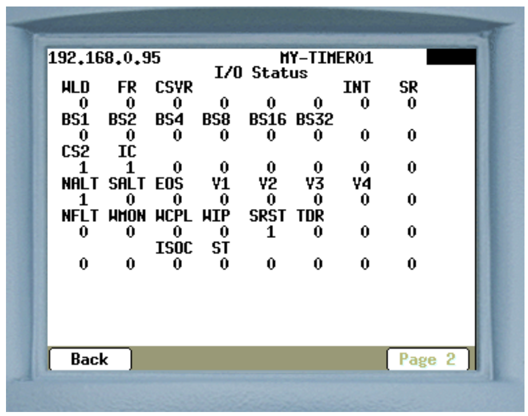


Figure 7.1 I/O Status Screen

The I/O Status Screen shows the status of every mapped I/O bit in the WT6000. Depending on the customer's application, this can include:

- FieldBus I/O
- Ethernet I/O
- Local I/O
- Discrete I/O

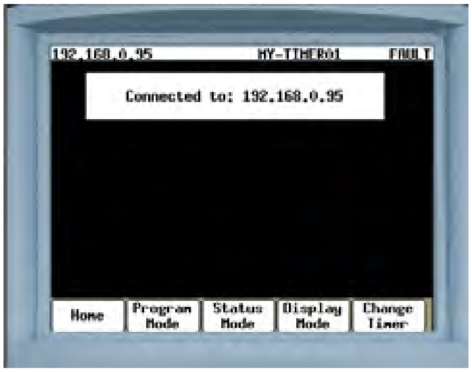
Each I/O bit is represented by an I/O tag. Each tag will have either a “1” or “0” underneath it:

- “1” indicates the bit is HIGH or ON.
- “0” indicates the bit is LOW or OFF.

I/O DEFAULTS

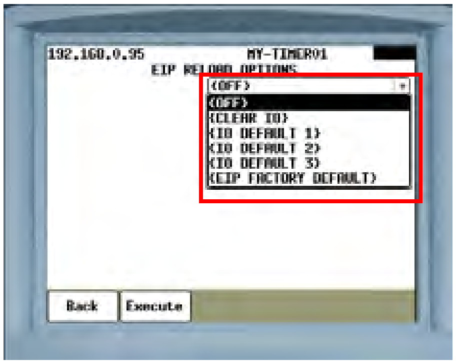
EIP I/O DEFAULT OPTIONS:

The weld processor software A15x50 offers three default EIP I/O options. The following procedure describes navigation to EIP I/O Default 1 using the DEP 300s.



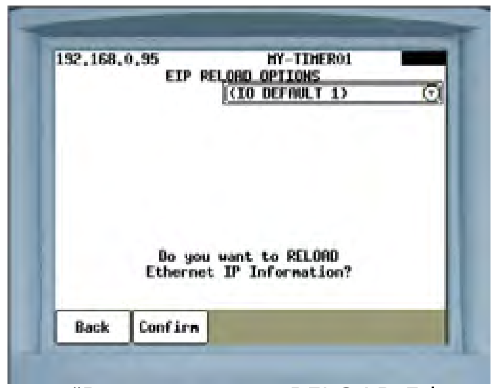
① Press F2 Program Mode.

② Press F5 More.



③ Press ENTER This opens a drop down list of Reload Defaults.

④ Use the arrow to select your desired default option and press . As the selected default is displayed in the Reload Default window press Execute .



⑤ The message “Do you want to RELOAD Ethernet IP information?” is displayed. Press to Confirm the selection. This is followed by the prompt “Download Complete Power Cycle Required.” Cycle power to apply the selection.

EIP INPUTS - DEFAULT 1

INPUT #	EIP INPUT BIT NAME	TAG NAME
1.	WELD / NO WELD	WLD
2.	FAULT RESET	FR
3.	ISOLATION CONTACTOR SAVER	CSVR
4.	NONE	-
5.	NONE	-
6.	NONE	-
7.	WELD INITIATE	INT
8.	STEPPER RESET	SR
9.	BINARY SELECT 1	BS1
10.	BINARY SELECT 2	BS2
11.	BINARY SELECT 4	BS4
12.	BINARY SELECT 8	BS8
13.	BINARY SELECT 16	BS16
14.	BINARY SELECT 32	BS32
15.	NONE	-
16.	NONE	-
17.	NONE	-
18.	NONE	-
19.	NONE	-
20.	NONE	-
21.	NONE	-
22.	NONE	-
23.	NONE	-
24.	NONE	-
25.	NONE	-
26.	NONE	-
27.	NONE	-
28.	NONE	-

INPUT #	EIP INPUT BIT NAME	TAG NAME
29.	NONE	-
30.	NONE	-
31.	NONE	-
32.	NONE	-
33.	NONE	-
34.	NONE	-
35.	NONE	-
36.	NONE	-
37.	NONE	-
38.	NONE	-
39.	NONE	-
40.	NONE	-
41.	NONE	-
42.	NONE	-
43.	NONE	-
44.	NONE	-
45.	NONE	-
46.	NONE	-
47.	NONE	-
48.	NONE	-
49.	NONE	-
50.	NONE	-
51.	NONE	-
52.	NONE	-
53.	NONE	-
54.	NONE	-
55.	NONE	-
56.	NONE	-
57.	NONE	-
58.	NONE	-

INPUT #	EIP INPUT BIT NAME	TAG NAME
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	NONE	-
64.	NONE	-

EIP OUTPUTS - DEFAULT 1

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
1.	NO ALERT	NALT
2.	STEPPER APPROACHING MAX	SALT
3.	END OF STEPPER	EOS
4.	VALVE 1	V1
5.	VALVE 2	V2
6.	VALVE 3	V3
7.	VALVE 4	V4
8.	NONE	-
9.	NO FAULT	NFLT
10.	WELD MODE ON	WMON
11.	WELD COMPLETE	WCPL
12.	WELD IN PROGRESS	WIP
13.	STEPPERS ARE RESET	SRST
14.	TIP DRESS REQUEST	TDR
15.	NONE	-
16.	NONE	-
17.	NONE	-
18.	NONE	-
19.	NONE	-

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
20.	NONE	-
21.	NONE	-
22.	NONE	-
23.	NONE	-
24.	NONE	-
25.	NONE	-
26.	NONE	-
27.	NONE	-
28.	NONE	-
29.	NONE	-
30.	NONE	-
31.	NONE	-
32.	NONE	-
33.	NONE	-
34.	NONE	-
35.	NONE	-
36.	NONE	-
37.	NONE	-
38.	NONE	-
39.	NONE	-
40.	NONE	-
41.	NONE	-
42.	NONE	-
43.	NONE	-
44.	NONE	-
45.	NONE	-
46.	NONE	-
47.	NONE	-
48.	NONE	-
49.	NONE	-

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
50.	NONE	-
51.	NONE	-
52.	NONE	-
53.	NONE	-
54.	NONE	-
55.	NONE	-
56.	NONE	-
57.	NONE	-
58.	NONE	-
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	NONE	-
64.	NONE	-

EIP INPUTS - DEFAULT 2

INPUT #	EIP INPUT BIT NAME	TAG NAME
1.	WELD / NO WELD	WLD
2.	FAULT RESET	FR
3.	ISOLATION CONTACTOR SAVER	CSVR
4.	NONE	-
5.	NONE	-
6.	NONE	-
7.	WELD INITIATE	INT
8.	STEPPER RESET	SR
9.	BINARY SELECT 1	BS1
10.	BINARY SELECT 2	BS2

INPUT #	EIP INPUT BIT NAME	TAG NAME
11.	BINARY SELECT 4	BS4
12.	BINARY SELECT 8	BS8
13.	BINARY SELECT 16	BS16
14.	BINARY SELECT 32	BS32
15.	BINARY SELECT 64	BS64
16.	BINARY SELECT 128	BS128
17.	SPOT 9 (256)	S9
18.	SPOT 10 (512)	S10
19.	SPOT 11 (1024)	S11
20.	SPOT 12 (2048)	S12
21.	SPOT 13 (4096)	S13
22.	SPOT 14 (8192)	S14
23.	SPOT 15 (16384)	S15
24.	SPOT 16 (32768)	S16
25.	SPOT 17 (65536)	S17
26.	SPOT 18 (131072)	S18
27.	SPOT 19 (262144)	S19
28.	SPOT 20 (524288)	S20
29.	SPOT 21 (1048576)	S21
30.	SPOT 22 (2097152)	S22
31.	SPOT 23 (4194304)	S23
32.	SPOT 24 (8388608)	S24
33.	SPOT 25 (16777216)	S25
34.	SPOT 26 (33554432)	S26
35.	SPOT 27 (67108864)	S27
36.	SPOT 28 (134217728)	S28
37.	SPOT 29 (268435456)	S29
38.	SPOT 30 (536870912)	S30
39.	NONE	-
40.	NONE	-

INPUT #	EIP INPUT BIT NAME	TAG NAME
41.	NONE	-
42.	NONE	-
43.	NONE	-
44.	NONE	-
45.	NONE	-
46.	NONE	-
47.	NONE	-
48.	NONE	-
49.	NONE	-
50.	NONE	-
51.	NONE	-
52.	NONE	-
53.	NONE	-
54.	NONE	-
55.	NONE	-
56.	NONE	-
57.	NONE	-
58.	NONE	-
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	NONE	-
64.	NONE	-

EIP OUTPUTS - DEFAULT 2

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
1.	NO ALERT	NALT
2.	STEPPER APPROACHING MAX	SALT
3.	END OF STEPPER	EOS
4.	VALVE 1	V1
5.	VALVE 2	V2
6.	VALVE 3	V3
7.	VALVE 4	V4
8.	NONE	-
9.	NO FAULT	NFLT
10.	WELD MODE ON	WMON
11.	WELD COMPLETE	WCPL
12.	WELD IN PROGRESS	WIP
13.	STEPPERS ARE RESET	SRST
14.	TIP DRESS REQUEST	TDR
15.	NONE	-
16.	NONE	-
17.	NONE	-
18.	NONE	-
19.	NONE	-
20.	NONE	-
21.	NONE	-
22.	NONE	-
23.	NONE	-
24.	NONE	-
25.	NONE	-
26.	NONE	-
27.	NONE	-
28.	NONE	-

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
29.	NONE	-
30.	NONE	-
31.	NONE	-
32.	NONE	-
33.	NONE	-
34.	NONE	-
35.	NONE	-
36.	NONE	-
37.	NONE	-
38.	NONE	-
39.	NONE	-
40.	NONE	-
41.	NONE	-
42.	NONE	-
43.	NONE	-
44.	NONE	-
45.	NONE	-
46.	NONE	-
47.	NONE	-
48.	NONE	-
49.	NONE	-
50.	NONE	-
51.	NONE	-
52.	NONE	-
53.	NONE	-
54.	NONE	-
55.	NONE	-
56.	NONE	-
57.	NONE	-
58.	NONE	-

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	NONE	-
64.	NONE	-

EIP INPUTS - DEFAULT 3

INPUT #	EIP INPUT BIT NAME	TAG NAME
1.	BINARY SELECT 1	BS1
2.	BINARY SELECT 2	BS2
3.	BINARY SELECT 4	BS4
4.	BINARY SELECT 8	BS8
5.	BINARY SELECT 16	BS16
6.	BINARY SELECT 32	BS32
7.	BINARY SELECT 64	BS64
8.	BINARY SELECT 128	BS128
9.	WELD INITIATE	INT
10.	WELD/NO WELD	WLD
11.	ISOLATION CONTACTOR SAVER	CSVR
12.	FAULT RESET	FR
13.	WELD PROCEED	WP1
14.	NONE	-
15.	STEPPER RESET GROUP 1	SRG1
16.	STEPPER RESET GROUP 2	SRG2
17.	NONE	-
18.	TIP DRESS GROUP 1	TDG1
19.	TIP DRESS GROUP 2	TDG2

INPUT #	EIP INPUT BIT NAME	TAG NAME
20.	STEPPER AUX WELD CNTR RESET	SACR
21.	APP ERR ACKNOWLEDGE	FACK
22.	CONTROL STOP	CSTP
23.	NONE	-
24.	SYSTEM COOLING	COOL
25.	NONE	-
26.	NONE	-
27.	USER INPUT 1	UI1
28.	USER INPUT 2	UI2
29.	USER INPUT 3	UI3
30.	USER INPUT 4	UI4
31.	USER INPUT 5	UI5
32.	USER INPUT 6	UI6
33.	NONE	-
34.	NONE	-
35.	SPOT 9 (256)	S9
36.	SPOT 10 (512)	S10
37.	SPOT 11 (1024)	S11
38.	SPOT 12 (2048)	S12
39.	SPOT 13 (4096)	S13
40.	SPOT 14 (8192)	S14
41.	SPOT 15 (16384)	S15
42.	SPOT 16 (32768)	S16
43.	SPOT 17 (65536)	S17
44.	SPOT 18 (131072)	S18
45.	SPOT 19 (262144)	S19
46.	SPOT 20 (524288)	S20
47.	SPOT 21 (1048576)	S21
48.	SPOT 22 (2097152)	S22
49.	SPOT 23 (4194304)	S23

INPUT #	EIP INPUT BIT NAME	TAG NAME
50.	SPOT 24 (8388608)	S24
51.	SPOT 25 (16777216)	S25
52.	SPOT 26 (33554432)	S26
53.	SPOT 27 (67108864)	S27
54.	SPOT 28 (134217728)	S28
55.	SPOT 29 (268435456)	S29
56.	SPOT 30 (536870912)	S30
57.	NONE	-
58.	NONE	-
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	FORCE MEASURE IN	FRCI
64.	TIP DRESS MOTOR ON	TDMI

EIP OUTPUTS - DEFAULT 3

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
1.	NO FAULT	NFLT
2.	NO ALERT	NALT
3.	FAULT	FLT
4.	ALERT	ALT
5.	WELD MODE ON	WMON
6.	NO WELD	NWM
7.	WELD IN PROGRESS	WIP
8.	WELD COMPLETE	WCPL
9.	READY TO WELD	RTW
10.	NONE	-

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
11.	STEPPERS ARE RESET GROUP 1	SRG1
12.	STEPPERS ARE RESET GROUP 2	SRG2
13.	NONE	-
14.	END OF STEPPER GROUP 1	ESG1
15.	END OF STEPPER GROUP 2	ESG2
16.	NONE	-
17.	STEPPER APPROCHING MAX GROUP 1	SAG1
18.	STEPPER APPROCHING MAX GROUP 2	SAG2
19.	NONE	-
20.	TIP CHANGE REQUIRED GROUP 1	TCG1
21.	TIP CHANGE REQUIRED GROUP 2	TCG2
22.	NONE	-
23.	TIP DRESS REQUEST GROUP 1	TDG1
24.	TIP DRESS REQUEST GROUP 2	TDG2
25.	STEPPER AUX COUNTER AT MAX	SACM
26.	APP ERROR AVAILABLE	EAVL
27.	APP ERROR BIT 1	ER1
28.	APP ERROR BIT 2	ER2
29.	APP ERROR BIT 4	ER4
30.	APP ERROR BIT 8	ER8
31.	APP ERROR BIT 16	ER16
32.	FORCE MEASURE OUT	FRCO
33.	FORGE FORCE 1	FF1
34.	FORGE FORCE 2	FF2
35.	FORGE FORCE 4	FF4
36.	FORGE FORCE 8	FF8
37.	FORGE FORCE 16	FF16
38.	FORGE FORCE 32	FF32
39.	FORGE FORCE 64	FF64

OUTPUT #	EIP OUTPUT BIT NAME	TAG NAME
40.	FORGE FORCE 128	FF128
41.	FORGE FORCE 256	FF256
42.	FORGE FORCE 512	FF512
43.	FORGE FORCE 1024	FF1K
44.	FORGE FORCE 2048	FF2K8
45.	FORGE FORCE 4096	FF4K
46.	FORGE FORCE 8192	FF8K
47.	FORGE	FRG
48.	NONE	-
49.	USER OUTPUT 1	UO1
50.	USER OUTPUT 2	UO2
51.	USER OUTPUT 3	UO3
52.	USER OUTPUT 4	UO4
53.	USER OUTPUT 5	UO5
54.	USER OUTPUT 6	UO6
55.	NONE	-
56.	WATER SAVER VALVE	WSVR
57.	NONE	-
58.	TIP DRESS MOTOR RUNNING	TDMR
59.	NONE	-
60.	NONE	-
61.	NONE	-
62.	NONE	-
63.	NONE	-
64.	NONE	-

Select from default options (IO Default 1, IO Default 2, IO Default 3, EIP Factory Default) as detailed in the procedure - “EIP I/O DEFAULT OPTIONS:” on page 157.

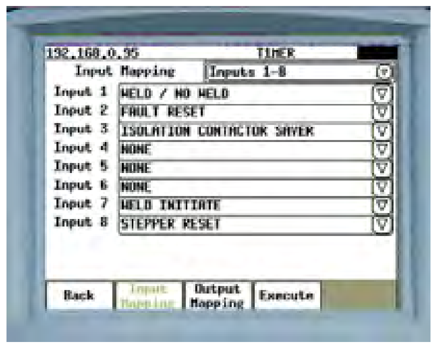
Follow the steps below to map the available EIP I/O points.

I/O MAPPING

The WT6000 is designed with Flexible I/O. This means the user has the capability of reconfiguring the I/O to meet the requirements of a particular application.

NOTE: WHEN LOADING A NEW I/O MAP OR DOWNLOADING A BACKUP FILE CLEAR ANY EXISTING I/O MAPS.

EIP INPUT MAPPING



The following explains how to reconfigure the EIP input Map. in this example, Input 4 will be re-mapped from the NONE bit to the PRESSURE SWITCH bit:

① Press Program Mode (F2).

② Press More (F5).

③ Press EIP Options (F2)

④ Press Input Mapping (F2)

⑤ Press the DOWN arrow key to move the cursor to the “Input 4" field.

⑥ Press ENTER. A drop-down box will appear containing all the available input bits.

⑦ Press the DOWN arrow key until the cursor is on the PRESSURE SWITCH bit.

⑧ Press ENTER. NONE will be replaced with PRESSURE SWITCH in the IInput 4 field.

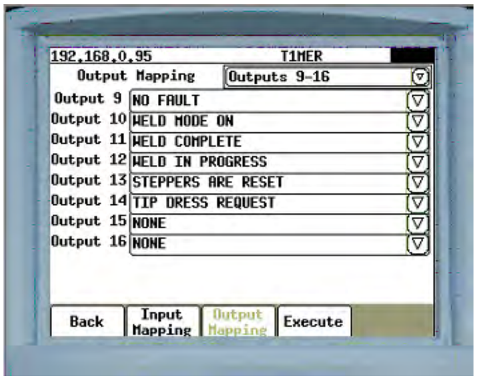
⑨ Press Execute (F4). This begins the process to download the change to the weld timer.

⑩ The message “Do you want to change EIP information” will appear. Press Confirm (F4).

⑪ The message Download complete power cycle required” will appear. Re-cycle power on the weld control to complete the process.

EIP OUTPUT MAPPING

The following explains how to reconfigure the EIP Output Map. in this example, Output 14 will be re-mapped from the TIP DRESS REQUEST bit to the VALVE 2 bit:



① Press Program Mode (F2).

② Press More (F5).

③ Press EIP Options (F2)

④ Press Output Mapping (F3)

⑤ Press ENTER. A drop-down box will appear.

⑥ Press the G arrow key once to move the cursor to “Outputs 9-16”.

⑦ Press ENTER.

⑧ Press the G arrow key to move the cursor to the “Input 14" field.

⑨ Press ENTER. A drop-down box will appear containing all the available output bits.

⑩ Press the G arrow key until the cursor is on the VALVE 2 bit.

⑪ Press ENTER. TIP DRESS REQUEST will be replaced with VALVE 2 in the input 14 field.

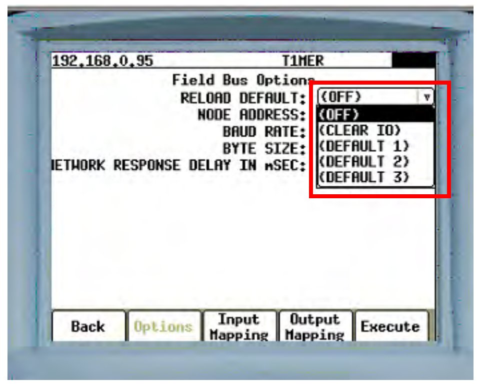
⑫ Press Execute (F4). This begins the process to download the change to the weld timer.

⑬ The message “Do you want to change EIP information” will appear. Press Confirm (F4).

⑭ The message “Download complete power cycle required” will appear. Re-cycle power on the weld control to complete the process.

FIELDBUS I/O MAPPING

The WT6000 is designed with Flexible I/O. This means the user has the capability of reconfiguring the I/O to meet the requirements of a particular application. The following default options are available:



FIELDBUS INPUT MAPPING

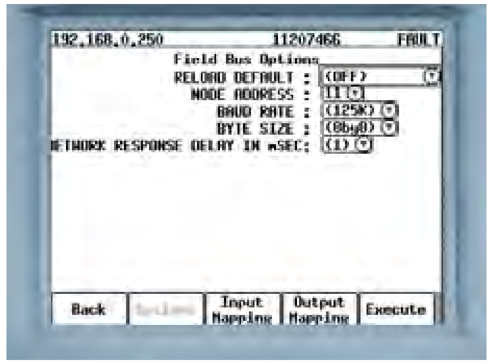
The following steps explains how to reconfigure the FieldBus input Map. In this example, input 8 will be re-mapped from the BINARY SELECT 128 bit to the TIP DRESS bit:

① Press  Program Mode.

② Press F5 More.

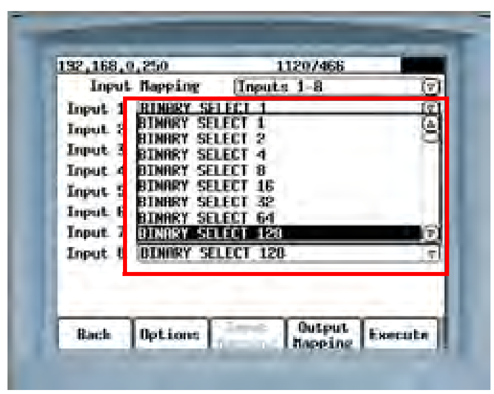
③ Press F5 More.

④ Press F2 FieldBus Mapping.



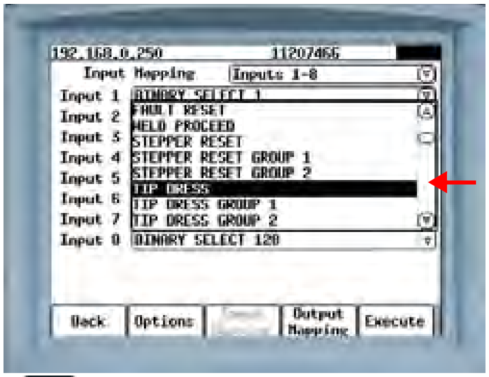
⑤ Press input Mapping.

⑥ Press the arrow key to move the cursor to the “input 8" field.

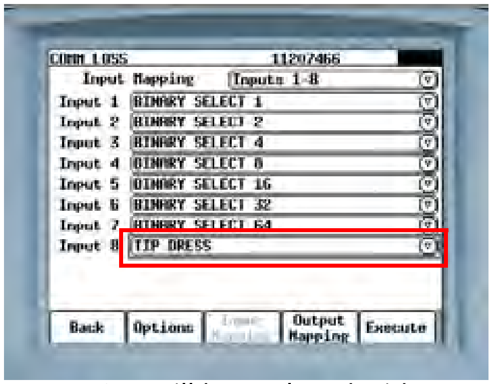


⑦ Press A drop-down box will appear containing all the available input bits.

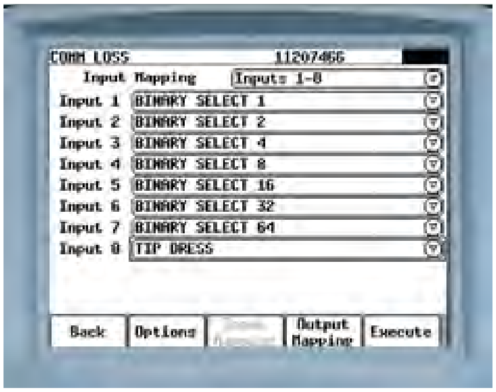
⑧ Press ENTER .



⑨ Press the arrow key until the cursor is on the TIP DRESS bit.



⑩ BINARY SELECT 128 will be replaced with TIP DRESS in the input 8 field.



⑪ Press Execute. This begins the process to download the change to the weld processor.

FIELDBUS OUTPUT MAPPING

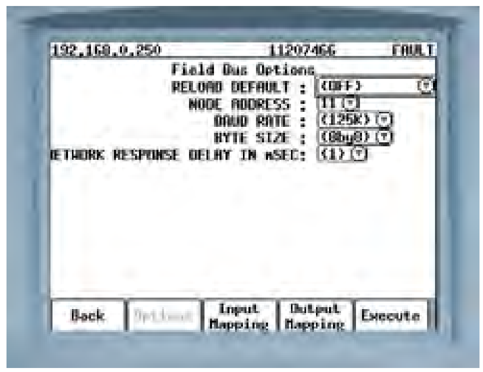
The following explains how to reconfigure the FieldBus Output Map. in this example, Output 11 will be re-mapped from the NONE bit to the TIP DRESS REQUEST bit.

① Press B F2 Program Mode.

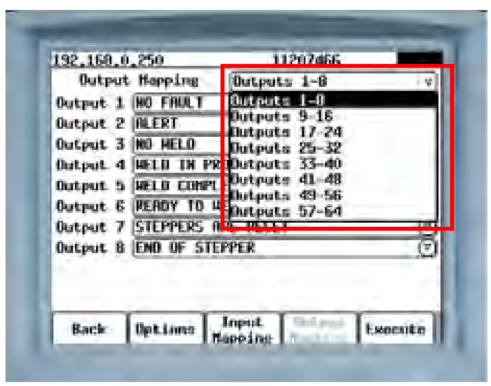
② Press E F5 More.

③ Press E F5 More.

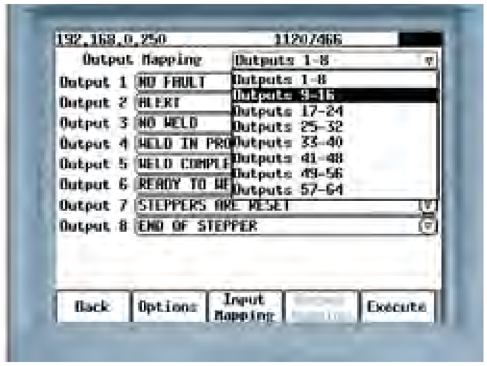
④ Press  FieldBus Mapping.



Press  output Mapping



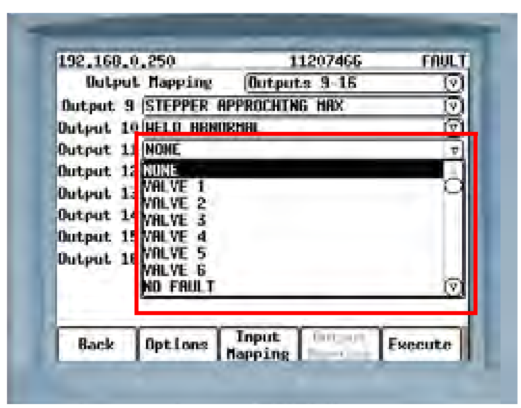
⑤ Press  A drop-down box will appear.



⑥ Press the  arrow key once to move the cursor to "Outputs 9-16".

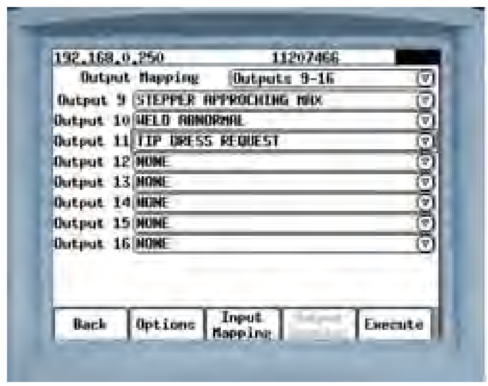
⑦ Press ENTER .

⑧ Press the  arrow key to move the cursor to the "Output 11" field.

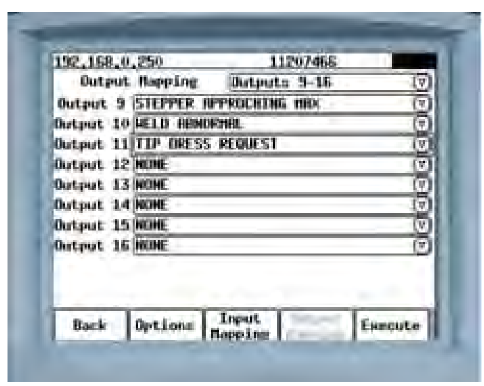


⑨ Press  A drop-down box will appear containing all the available output bits.

⑩ Press the arrow key until the cursor is on the TIP DRESS REQUEST bit.

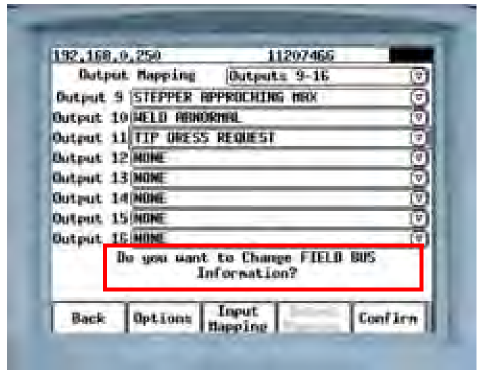


⑪ Press NONE will be replaced with TIP DRESS REQUEST in the Output 11 field.

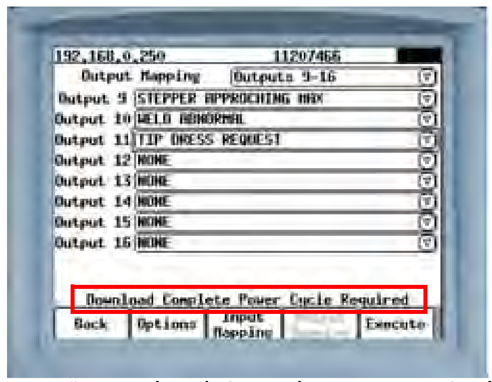


⑫ Press Execute.

⑬ This begins the process to download the change to the weld processor.



⑭ The message "Do you want to Change FIELD BUS information" will appear. Press  to Confirm.



⑮ The message "Download Complete Power Cycle Required" will appear. Re-cycle power on the weld control to complete the process.

FIELDBUS INPUTS- DEFAULT 1

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
1	WELD / NO WELD	WLD				
2	FAULT RESET	FR				
3	APP ERR ACKNOWLEDGE	FACK				
4	BINARY SELECT 1	BS1				
5	BINARY SELECT 2	BS2				
6	BINARY SELECT 4	BS4				
7	BINARY SELECT 8	BS8				
8	BINARY SELECT 16	BS16				
9	BINARY SELECT 32	BS32	2 by 2			
10	WELD INITIATE	INT				
11	NONE	-				
12	NONE	-				
13	STEPPER RESET	SR				
14	ISOLATION CONTACTOR SAVER	CSVR				
15	CONTROL STOP	CSTP				
16	TIP DRESS	TIPD				
17	NONE	-				
18	STEPPER RESET GROUP 1	SRG1				
19	STEPPER RESET GROUP 2	SRG2				
20	NONE	-		4 by 4		
21	TIP DRESS GROUP 1	TDG1				
22	TIP DRESS GROUP 2	TDG2				
23	NONE	-				
24	NONE	-				
25	NONE	-				
26	NONE	-				
27	NONE	-				
28	NONE	-				

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME		BYTE SIZE		
29	NONE	-			6 by 6	
30	NONE	-				
31	NONE	-				
32	NONE	-				

FIELDBUS OUTPUTS - DEFAULT 1

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
1	WELD MODE ON	WMON	2 by 2	4 by 4		
2	NO FAULT	NFLT				
3	NO ALERT	NALT				
4	APP ERROR AVAILABLE	EVAL				
5	APP ERROR BIT 1	ER1				
6	APP ERROR BIT 2	ER2				
7	APP ERROR BIT 4	ER4				
8	APP ERROR BIT 8	ER8				
9	APP ERROR BIT 16	ER16				
10	WELD COMPLETE	WCPL				
11	WELD IN PROGRESS	WIP				
12	STEPPERS ARE RESET	SRST				
13	STEPPER APPROACHING MAX	SALT				
14	END OF STEPPER	EOS				
15	READY TO WELD	RTW				
16	TIP DRESS REQUEST	TDR				
17	NONE	-				
18	STEPPERS ARE RESET GROUP 1	SRG1				

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
19	STEPPERS ARE RESET GROUP 2	SRG2				
20	NONE	-				
21	END OF STEPPER GROUP 1	ESG1			6 by 6	
22	END OF STEPPER GROUP 2	ESG2				
23	NONE	-				
24	STPR APPROACHING MAX GROUP 1	SAG1				
25	STPR APPROACHING MAX GROUP 2	SAG2				
26	NONE	-				
27	TIP DRESS REQUEST GROUP 1	TDG1				8 by 8
28	TIP DRESS REQUEST GROUP 2	TDG2				
29	NONE	-				
30	NONE	-				
31	NONE	-				
32	NONE	-				

FIELDBUS INPUTS - DEFAULT 2

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
1	WELD / NO WELD	WLD				
2	FAULT RESET	FR				
3	ISOLATION CONTACTOR SAVER	CSVR				
4	NONE	-				
5	NONE	-				
6	NONE	-				
7	WELD INITIATE	INT				
8	STEPPER RESET	SR				
9	BINARY SELECT 1	BS1				
10	BINARY SELECT 2	BS2				
11	BINARY SELECT 4	BS4	2 by 2			
12	BINARY SELECT 8	BS8				
13	BINARY SELECT 16	BS16				
14	BINARY SELECT 32	BS32				
15	BINARY SELECT 64	BS64				
16	BINARY SELECT 128	BS128				
17	SPOT 9 (256)	S9				
18	SPOT 10 (512)	S10				
19	SPOT 11 (1024)	S11				
20	SPOT 12 (2048)	S12		4 by 4		
21	SPOT 13 (4096)	S13				
22	SPOT 14 (8192)	S14				
23	SPOT 15 (16384)	S15				
24	SPOT 16 (32768)	S16				
25	SPOT 17 (65536)	S17			6 by 6	
26	SPOT 18 (131072)	S18				
27	SPOT 19 (262144)	S19				
28	SPOT 20 (524288)	S20				

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
29	SPOT 21 (1048576)	S21				
30	SPOT 22 (2097152)	S22				
31	SPOT 23 (4194304)	S23				
32	SPOT 24 (8388608)	S24				
33	SPOT 25 (16777216)	S25				
34	SPOT 26 (33554432)	S26				
35	SPOT 27 (67108864)	S27				
36	SPOT 28 (134217728)	S28				
37	SPOT 29 (268435456)	S29				
38	SPOT 30 (536870912)	S30				
39	NONE	-				
40	NONE	-				
41	NONE	-				
42	NONE	-				
43	NONE	-				8 by 8
44	NONE	-				
45	NONE	-				
46	NONE	-				
47	NONE	-				
48	NONE	-				

FIELDBUS OUTPUTS - DEFAULT 2

<table>
<tr><th>OUTPUT #</th><th>FIELDBUS OUTPUT BIT NAME</th><th>TAG NAME</th><th colspan="4">BYTE SIZE</th></tr>
<tr><td>1</td><td>WELD MODE ON</td><td>WMON</td><td rowspan="16">2 by 2</td><td rowspan="26">4 by 4</td><td rowspan="26">6 by 6</td><td rowspan="26"></td></tr>
<tr><td>2</td><td>NO FAULT</td><td>NFLT</td></tr>
<tr><td>3</td><td>NO ALERT</td><td>NALT</td></tr>
<tr><td>4</td><td>APP ERROR AVAILABLE</td><td>EVAL</td></tr>
<tr><td>5</td><td>APP ERROR BIT 1</td><td>ER1</td></tr>
<tr><td>6</td><td>APP ERROR BIT 2</td><td>ER2</td></tr>
<tr><td>7</td><td>APP ERROR BIT 4</td><td>ER4</td></tr>
<tr><td>8</td><td>APP ERROR BIT 8</td><td>ER8</td></tr>
<tr><td>9</td><td>APP ERROR BIT 16</td><td>ER16</td></tr>
<tr><td>10</td><td>WELD COMPLETE</td><td>WCPL</td></tr>
<tr><td>11</td><td>WELD IN PROGRESS</td><td>WIP</td></tr>
<tr><td>12</td><td>STEPPERS ARE RESET</td><td>SRST</td></tr>
<tr><td>13</td><td>STEPPER APPROACHING MAX</td><td>SALT</td></tr>
<tr><td>14</td><td>END OF STEPPER</td><td>EOS</td></tr>
<tr><td>15</td><td>READY TO WELD</td><td>RTW</td></tr>
<tr><td>16</td><td>TIP DRESS REQUEST</td><td>TDR</td></tr>
<tr><td>17</td><td>NONE</td><td>-</td><td></td></tr>
<tr><td>18</td><td>STEPPERS ARE RESET GROUP 1</td><td>SRG1</td><td></td></tr>
<tr><td>19</td><td>STEPPERS ARE RESET GROUP 2</td><td>SRG2</td><td></td></tr>
<tr><td>20</td><td>NONE</td><td>-</td><td></td></tr>
<tr><td>21</td><td>END OF STEPPER GROUP 1</td><td>ESG1</td><td></td></tr>
<tr><td>22</td><td>END OF STEPPER GROUP 2</td><td>ESG2</td><td></td></tr>
<tr><td>23</td><td>NONE</td><td>-</td><td></td></tr>
<tr><td>24</td><td>STEPPER APPROACHING MAX GROUP 1</td><td>SAG1</td><td></td></tr>
<tr><td>25</td><td>STEPPER APPROACHING MAX GROUP 2</td><td>SAG2</td><td></td></tr>
<tr><td>26</td><td>NONE</td><td>-</td><td></td></tr>
</table>

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
27	TIP DRESS REQUEST GROUP 1	TDG1				8 by 8
28	TIP DRESS REQUEST GROUP 2	TDG2				
29	NONE	-				
30	NONE	-				
31	NONE	-				
32	NONE	-				
33	NONE	-				
34	NONE	-				
35	NONE	-				
36	NONE	-				
37	NONE	-				
38	NONE	-				
39	NONE	-				
40	NONE	-				
41	NONE	-				
42	NONE	-				
43	NONE	-				
44	NONE	-				
45	NONE	-				
46	NONE	-				
47	NONE	-				
48	NONE	-				

FIELDBUS INPUTS - DEFAULT 3

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
1	BINARY SELECT 1	BS1	2 by 2	4 by 4		
2.	BINARY SELECT 2	BS2				
3.	BINARY SELECT 4	BS4				
4.	BINARY SELECT 8	BS8				
5.	BINARY SELECT 16	BS16				
6.	BINARY SELECT 32	BS32				
7.	BINARY SELECT 64	BS64				
8.	BINARY SELECT 128	BS128				
9.	WELD INITIATE	INT				
10.	WELD / NO WELD	WLD				
11.	ISOLATION CONTACTOR SAVER	CSVR				
12.	FAULT RESET	FR				
13.	WELD PROCEED	WP1				
14.	NONE	-				
15.	STEPPER RESET GROUP 1	SRG1				
16	STEPPER RESET GROUP 2	SRG2				
17	NONE	-				
18	TIP DRESS GROUP 1	TDG1				
19	TIP DRESS GROUP 2	TDG2				
20	STEPPER AUX WELD CNTR RESET	SACR				
21	APP ERR ACKNOWLEDGE	FACK				
22	CONTROL STOP	CSTP				
23	NONE	-				
24	SYSTEM COOLING	COOL				
25	NONE	-				
26	NONE	-				
27	USER INPUT 1	UI1				

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
28	USER INPUT 2	UI2				
29	USER INPUT 3	UI3				
30	USER INPUT 4	UI4				
31	USER INPUT 5	UI5				
32	USER INPUT 6	UI6				
33	NONE	-				
34	NONE	-				
35	SPOT 9 (256)	S9				
36	SPOT 10 (512)	S10				
37	SPOT 11 (1024)	S11				
38	SPOT 12 (2048)	S12				
39	SPOT 13 (4096)	S13				
40	SPOT 14 (8192)	S14				
41	SPOT 15 (16384)	S15				
42	SPOT 16 (32768)	S16				
43	SPOT 17 (65536)	S17			6 by 6	
44	SPOT 18 (131072)	S18				
45	SPOT 19 (262144)	S19				
46	SPOT 20 (524288)	S20				
47	SPOT 21 (1048576)	S21				
48	SPOT 22 (2097152)	S22				
49	SPOT 23 (4194304)	S23				
50	SPOT 24 (8388608)	S24				
51	SPOT 25 (16777216)	S25				
52	SPOT 26 (33554432)	S26				
53	SPOT 27 (67108864)	S27				
54	SPOT 28 (134217728)	S28				
55	SPOT 29 (268435456)	S29				
56	SPOT 30 (536870912)	S30				
57	NONE	-				

INPUT #	FIELDBUS INPUT BIT NAME	TAG NAME	BYTE SIZE			
58	NONE	-				8 by 8
59	NONE	-				
60	NONE	-				
61	NONE	-				
62	NONE	-				
63	FORCE MEASURE IN	FRCI				
64	TIP DRESS MOTOR ON	TDMI				

FIELDBUS OUTPUTS DEFAULT 3

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
1.	NO FAULT	NFLT	2 by 2	4 by 4	6 by 6	
2	NO ALERT	NALT				
3	FAULT	FLT				
4	ALERT	ALT				
5	WELD MODE ON	WMON				
6	NO WELD	NWM				
7	WELD IN PROGRESS	WIP				
8	WELD COMPLETE	WCPL				
9	READY TO WELD	RTW				
10	NONE	-				
11	STEPPERS ARE RESET GROUP 1	SRG1				
12	STEPPERS ARE RESET GROUP 2	SRG2				
13	NONE	-				
14	END OF STEPPER GROUP 1	ESG1				
15	END OF STEPPER GROUP 2	ESG2				
16	NONE	-				
17	STEPPER APPROACHING MAX GROUP 1	SAG1				
18	STEPPER APPROACHING MAX GROUP 2	SAG2				
19	NONE	-				
20	TIP CHANGE REQUIRED GROUP 1	TCG1				
21	TIP CHANGE REQUIRED GROUP 2	TCG2				
22	NONE	-				
23	TIP DRESS REQUEST GROUP 1	TDG1				
24	TIP DRESS REQUEST GROUP 2	TDG2				
25	STEPPER AUX COUNTER AT MAX	SACM				
26	APP ERROR AVAILABLE	EVAL				
27	APP ERROR BIT 1	ER1				

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
28	APP ERROR BIT 2	ER2				8 by 8
29	APP ERROR BIT 4	ER4				
30	APP ERROR BIT 8	ER8				
31	APP ERROR BIT 16	ER16				
32	FORCE MEASURE OUT	FRCO				
33	FORGE FORCE 1	FF1				
34	FORGE FORCE 2	FF2				
35	FORGE FORCE 4	FF4				
36	FORGE FORCE 8	FF8				
37	FORGE FORCE 16	FF16				
38	FORGE FORCE 32	FF32				
39	FORGE FORCE 64	FF64				
40	FORGE FORCE 128	FF128				
41	FORGE FORCE 256	FF256				
42	FORGE FORCE 512	FF512				
43	FORGE FORCE 1024	FF1K				
44	FORGE FORCE 2048	FF2K				
45	FORGE FORCE 4096	FF4K				
46	FORGE FORCE 8192	FF8K				
47	FORGE	FRG				
48	NONE	-				
49	USER OUTPUT 1	UO1				
50	USER OUTPUT 2	UO2				
51	USER OUTPUT 3	UO3				
52	USER OUTPUT 4	UO4				
53	USER OUTPUT5	UO5				
54	USER OUTPUT 6	UO6				
55	NONE	-				
56	WATER SAVER VALVE	WSVR				
57	NONE	-				

OUTPUT #	FIELDBUS OUTPUT BIT NAME	TAG NAME	BYTE SIZE			
58	TIP DRESS MOTOR RUNNING	TDMR				
59	NONE	-				
60	NONE	-				
61	NONE	-				
62	NONE	-				
63	NONE	-				
64	NONE	-				

Chapter 8: LINEAR CURRENT STEPPERS

THE PURPOSE OF LINEAR CURRENT STEPPERS

During the welding process, the face of the welding cap gradually deforms or “mushrooms.” As it does, the contact surface area with the work piece increases, causing the current density at the weld interface to decrease. As a result, the weld nugget gradually becomes colder.

The purpose of a Linear Current Stepper is to gradually increase the welding current, in incremental steps, to compensate for the gradual decrease in current density at the weld interface, caused by the “mushrooming” of the welding caps. This gradual increase in welding current ensures the appropriate amount of heat is continuously present at the weld interface to continually make good weld nuggets.

Each stepper tracks the number of welds initiated and gradually increases the heat supplied to the weld at several programmable set points.

HOW LINEAR CURRENT STEPPERS WORK

Heat is added to the weld in several “steps”. Each step supplies additional weld current in a linear fashion over a programmed number of welds. It is the amount of stepper “boost” or the amount of current the stepper adds to the weld function. When the stepper reaches the last programmed set point (the last weld in the last step), the electrodes must be dressed or replaced, and the stepper reset.

The WTC weld control with software A15X50 has 10 available linear stepper programs. Each stepper program has 5 programmable steps.

The operator programs the stepper based on experience with the welding process and resulting electrode deterioration.

Within each of the 5 steps, the user can program the current boost (rise) over a number of welds (run).

The **Stepper Status** display shows the stepper boost in two ways:

- As a percent of maximum available primary current
- As a percent of target current

As the amount of stepper boost increases (in the latter steps of the profile), you must expand the window of acceptable secondary current to avoid generating HIGH CURRENT LIMIT fault or a LOW CURRENT LIMIT fault if a negative value is programmed.

To use a linear current stepper, function #82 (LINEAR STEPPER #nn ASSIGNED) must be inserted before the main weld statement (Function #20 or #30) in the weld schedule.

Stepper programs are only active during the execution of a weld function and will increment when the following functions are used in the weld schedule:

FUNCTION #	WELD FUNCTION
20	WELD nnnn <CY/IMP> nn %VS
21	TEMPER nnnn MS. nn %VS
22	PREHEAT nnnn MS. nn %VS
23	POSTHEAT nnnn MS. nn %VS
24	PRE-WELD nnnn MS. nn %VS

FUNCTION #	WELD FUNCTION
40	SLOPE nnnn MS. nn%VS TO nn%VS
30	WELD nnnn <CY/IMP> nnnn0 AMPS
31	TEMPER nnnn MS. nnnn0 AMPS

FUNCTION #	CONSTANT CURRENT WELD FUNCTION
32	PREHEAT nnnn MS. nnnn0 AMPS
33	POSTHEAT nnnn MS. nnnn0 AMPS
34	PRE-WELD nnnn MS. nnnn0 AMPS
37	WELD nn IMP HI= nnnnn0 A LO= nnnnn0 A
45	SLOPE nnnn MS. nnnn0 A TO nnnn0 A

STEPPER PROFILES

The Stepper Profile is available for the operator to view, edit or copy the conditions of a specific stepper program. The program A15X50 has 10 steppers and each stepper has five steps.

On each step, you program a boost (rise) over a number of welds (runs). The rise for each step is expressed as either percentage or absolute amps. If the weld being boosted is programmed as a percentage, then the rise that is expressed in percentage is used. If the weld being boosted is programmed in current regulation, then the rise that is expressed in absolute current values is used.

The boost (rise) is “linearized” over the number of welds. This means that the control provided incremental boosts within a step.

In the example below, each step has two current values. The first value **(blue)** is a percentage value and the second value **(red)** is an absolute Amps value.

NOTE:

IF A PERCENTAGE OF AVAILABLE VOLT-SECOND WELD FUNCTION IS USED IN THE WELD SCHEDULE AND BOTH A PERCENTAGE AND ABSOLUTE AMPS VALUE IS ENTERED IN THE STEP, THE ABSOLUTE AMPS VALUE IS IGNORED BY THE WELD PROCESSOR. CONVERSELY, IF A CONSTANT CURRENT WELD FUNCTION IS USED, THE PERCENTAGE VALUE IS IGNORED.

STEP	% VALUE	AMPS. VALUE	WELD FUNCTION
①	00%	1000 AMPS	100 WELDS
②	00%	500 AMPS	100 WELDS
③	00%	200 AMPS	100 WELDS
④	00%	100 AMPS	100 WELDS
⑤	00%	050 AMPS	100 WELDS

Stepper Group - 0-99
Maximum Tip Dresses= 0 - 99
Aux. Counter Max. Counts = 0 - 99999

STEPPER GROUPS

Steppers can be assigned to a group. This capability allows for incrementing the stepper when the control executes any weld schedule assigned to a stepper belonging to a common group. You can advance or reset a group of steppers. Also, if desired, the user may assign a single weld schedule to an individual stepper program.

For example, if one gun (tips) was used by several different schedules using different steppers, grouping allows for automatic increment of the weld count for every stepper in the group, every time the gun is fired regardless of the weld schedule the stepper combination it was initiated with. In addition, stepper grouping allows the user to advance or reset several stepper programs at one time. The stepper group range is 0-99.

EDITING THE STEPPER PROFILE

You can program new values for each of the five steps in the stepper profile. The following procedure describes the process using the DEP-300s:

① Press  Program Mode.

② Press  Review Stepper.

③ Press  Stepper #.

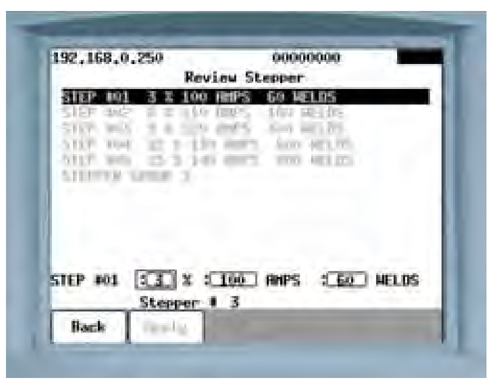
④ Enter Stepper Number

⑤ Press ENTER.

EDITING A PARAMETER ON THE REVIEW STEPPER MENU ON THE DEP 300s:

① Press the or arrow keys to move the cursor onto the parameter line to be edited.

② Press ENTER.



③ Enter parameter .

④ Press ENTER.

⑤ For parameters with two or more data fields, press the arrow key to move the cursor to the next data field box, then repeat steps 3 & 4. When complete, proceed to step 6.

⑥ Press APPLY [Saves changes to the DEP-300s only.].

⑦ To edit more parameter lines, repeat steps 1 through 6. When complete, proceed to step 8.

⑧ Press DOWNLOAD

[Downloads the changes to the weld processor. When complete, a **"Download Complete"** message will appear].

HOW STEPPER PROFILING WORKS

The following is an example of a stepper profile with ***a tip dress schedule.*** This example would typically be used in a robot welding application.

EXAMPLE SCHEDULE (TIP DRESS)	
00	START OF SCHEDULE # 1
82	LINEAR STEPPER #1 ASSIGNED (0 = OFF)
76	SEC. CURR LIMITS: HI= 00 LO= 99990
81	TRANSFORMER TURNS RATIO 73:1
88	TURN ON ISOLATION CONTACTOR
58	TURN ON WELD IN PROGRESS
01	SQUEEZE 30 CYCLES
30	WELD 10 CY. 10000 AMPS
03	HOLD 5 CYCLES
63	TURN ON WELD COMPLETE
59	TURN OFF WELD IN PROGRESS
75	EXTEND UNTIL NO INITIATE
64	TURN OFF WELD COMPLETE
89	TURN OFF ISOLATION CONTACTOR
100	END OF SCHEDULE # 1

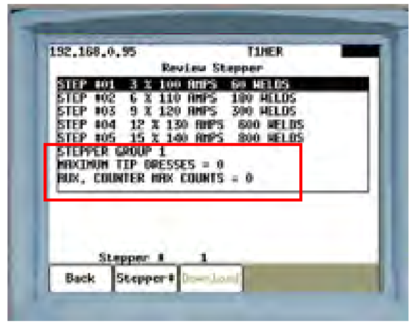
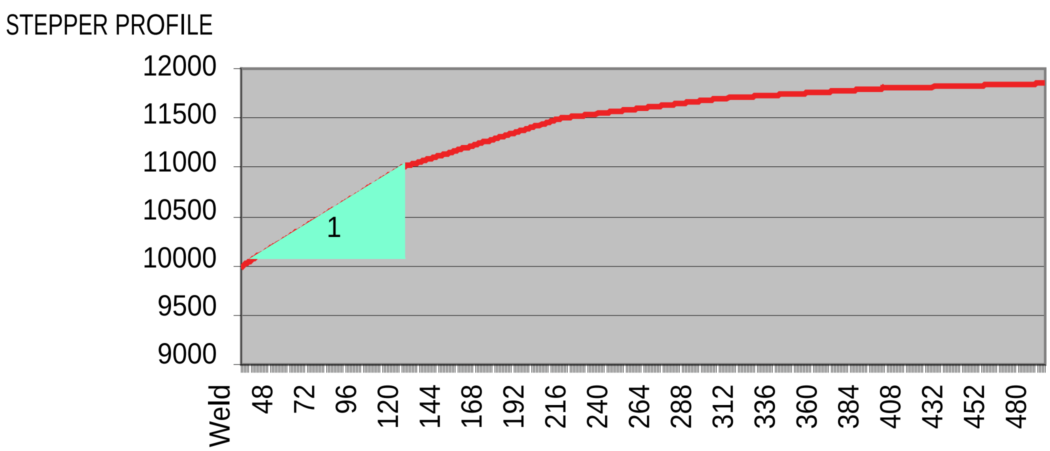


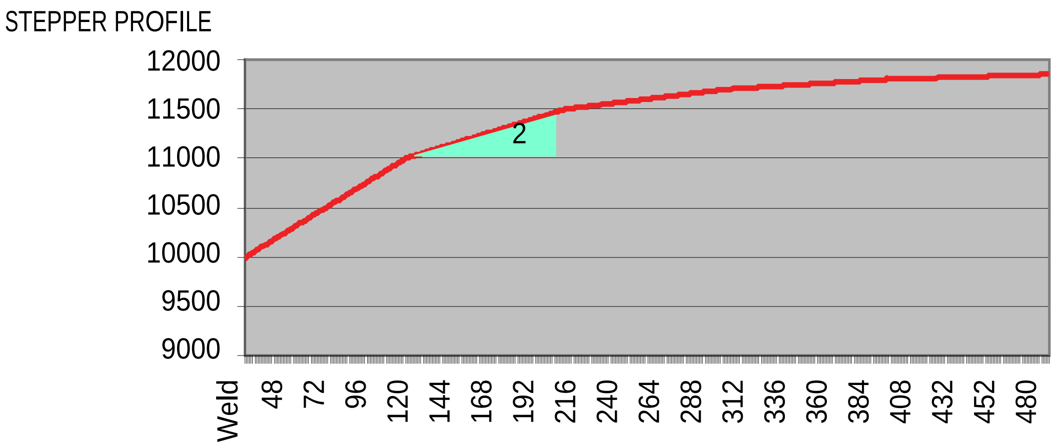
Figure 8.1 Stepper Profile as viewed from the DEP 300s.

THE FOLLOWING EXPLAINS EACH PARAMETER WITHIN THE PROFILE:

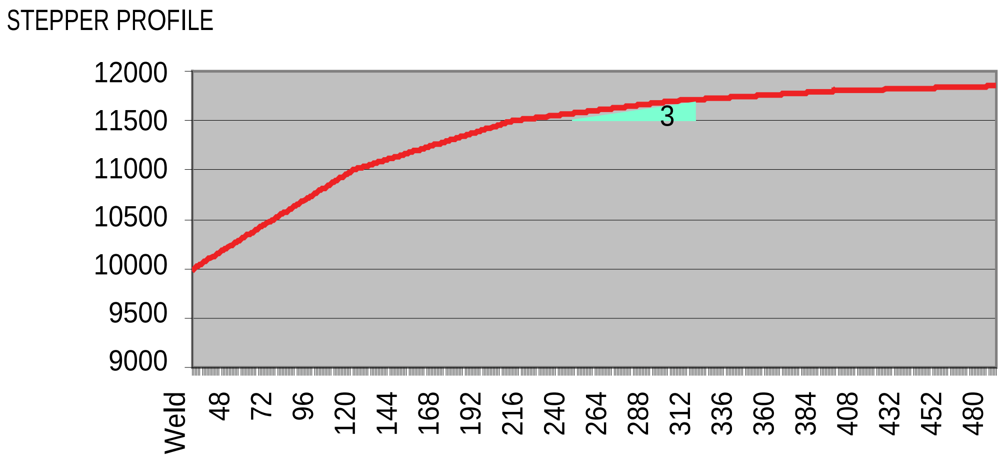


F 30: Weld 10 CY 10000 Amps - Base Weld Current

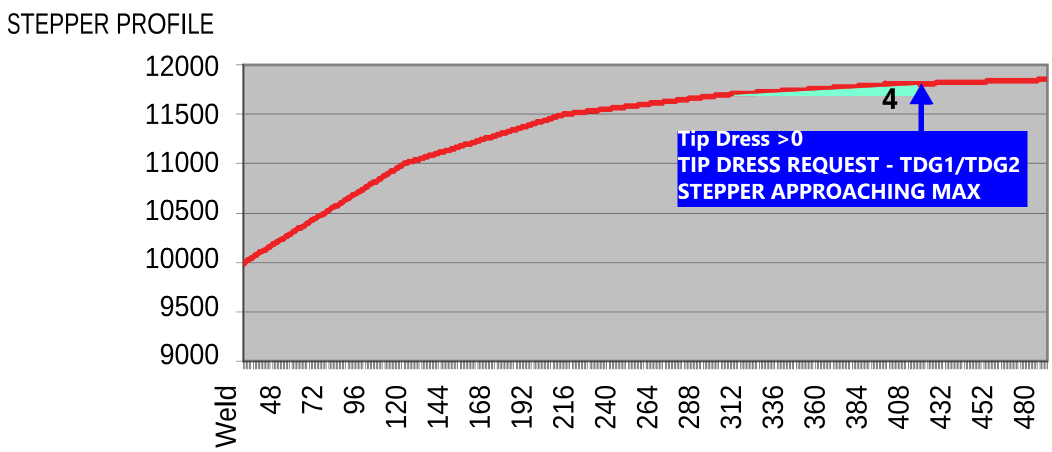
- **STEP # 01 = + 00% + 1000 A AFTER 100 WELDS**
  Step 1 is programmed to deliver a 1000A boost over 100 welds. If the base current is 10000 Amps, the boost current will increment by 10A after each weld, thus by the 100th weld, the target current will be at 11000A.



- **STEP # 02 = + 00% + 0500 A AFTER 100 WELDS**
  Step 2 is programmed to deliver a 500A boost over 100 welds. If the base current is 11000 Amps, the boost current will increment by 5A after each weld, thus by the 100th weld, the target current will be 11500A.



- **STEP # 03 = + 00% + 0200 A AFTER 100 WELDS**
  In the given example the boost of step 3 is to increase 200A over 100 welds because the weld function is expressed in Current Regulation Mode. Linearly, the control will boost 2A per weld. These values are in addition to Step 1 and Step 2.



- **STEP # 04 = + 00% + 0100 A AFTER 0100 WELDS**
  Step 4 is programmed to deliver a 100A boost over 100 welds. If the base current is 11700 Amps, the boost current will increment by 1A after each weld, thus by the 100th weld, the target current will be 11800A.

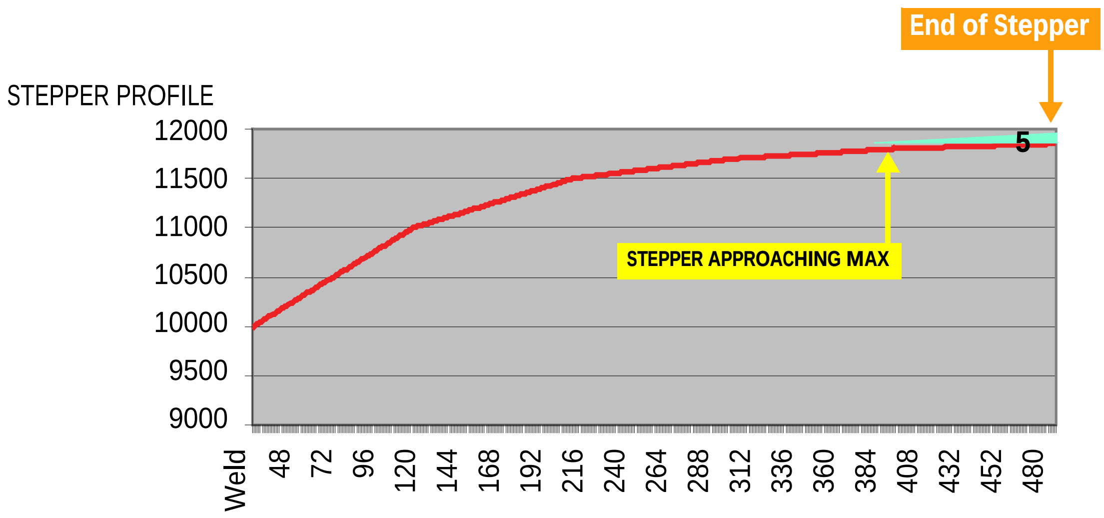
TIP DRESS REQUEST

After the last weld of Step 4, the weld control will turn on the Tip Dress Request (TDR) output together with the active Group output (TDG1 or TDG2). For group numbers greater than TDG2, for example Group 3 - Group 99, only TDR is annunciated since that is a global output.

A tip dress schedule can be run at any time from now until end of stepper.

Upon completion of the Tip Dress schedule, the weld processor will return the stepper program back to the first weld of Step X (Step number programmed in Function # 93).

NOTE: The Tip Dress Request (TDR) output is not annunciated if zero welds are programmed in Step 4.



- **STEP # 05 = + 00% + 0050 A AFTER 0100 WELDS**
  Step 5 is programmed to deliver a 50A boost over 100 welds. If the base current is 11800 Amps, the boost current will increment by 0.5A after each weld, thus by the 100th weld, the target current will be 11850A.

  At the end of step 5 the control will assert an END OF STEPPER fault with its corresponding output (EOS).

IF END OF STEPPER (EOS) IS PROGRAMMED AS A FAULT IN THE SETUP PARAMETERS, THE WELDING WILL STOP AND REQUIRE A FAULT RESET AT EVERY WELD TO WORK THROUGH THE PART.

EXAMPLE OF A TIP DRESS SCHEDULE

TIP DRESS SCHEDULE	
00	START OF SCHEDULE # 30
58	TURN ON WELD IN PROGRESS
01	SQUEEZE 30 CYCLES
93	TIP DRESS ADVANCE: GROUP 01 - STEP 2
63	TURN ON WELD COMPLETE
59	TURN OFF WELD IN PROGRESS
75	EXTEND UNTIL NO INITIATE
64	TURN OFF WELD COMPLETE
100	END OF SCHEDULE # 30

Example shows Schedule #30 is programmed to return all steppers associated to Group 1 to the start of Step 2.

When the control issues a "Tip Dress Request" output, the robot energizes the tip dresser (air or electric) and closes the gun on the tip dresser for a programmed amount of time to cut the electrodes. At any time during or after this takes place, the robot initiates Tip Dress Schedule (# 30 as shown in the example above).

At the start of this schedule, the Weld in Progress (WIP) output comes on to inform the robot it has accepted the schedule and is in process. The squeeze time is inserted only to allow time for this output to be scanned. Following the squeeze termination all steppers associated with Group 1 will be advanced to the first weld of Step 2 (function allows step range 1-2) in the stepper program. The remaining tip dress counter is decremented by 1. The Weld in Progress (WIP) output is turned OFF and the Weld Complete (WCPL) output is turned ON and remains on as long as the Weld Initiate (INT) input is maintained by the robot. The time between the turn ON and turn OFF of a Weld Complete is determined by the robot scan of time needed to see the turn ON of the Weld Complete (WCPL) signal. Once the initiate is removed, the Weld Complete is turned OFF and the sequence is terminated.

If the remaining Tip Dress count is greater than 0, the control will continue on to Step X (Step number as programmed in the schedule function #93) and work towards the following Step upon where another Tip Dress Request will be issued.

This routine continues until the Tip Dress counter hits 0.
The weld control will now proceed through the welds of Step 4 and continue on to Step 5.

INPUTS AND OUTPUTS RELATED TO STEPPER OPERATION:

▶ **INPUTS:**

STEPPER RESET -[SR]-
Resets all steppers to Step 1 and the weld count to 0.

▶ **OUTPUTS:**
TDR - TDG1/2 - TCR
Tip Dress Request Group 1/2 (TDG1/2) is annunciated at the first weld of step 5 when the stepper program is associated to groups 1 or 2.

SALT - EOS -
At the first weld of step 5 Stepper Approaching Max (SALT) output is generated with the active Group output (Group 1/2 - SAG1/2). These outputs (SALT/SAG1/2) will remain active until the last weld of step 5 is executed, at which time the END OF STEPPER (EOS) Fault is annunciated.

AUX. COUNTER MAX COUNTS:
Attached to each stepper program is an Auxiliary Weld Counter, which is located in the Stepper Status Menu. When a stepper increments, its auxiliary weld counter also increments. When the counter reaches the value programmed in this parameter, the Stepper Aux Counter At Max (SACM) output bit goes HIGH. This output bit can be used for any purpose by the user. Turning the Stepper Aux Weld Cntr Reset (SACR) input bit HIGH resets the Auxiliary Weld Counter to zero and turns the Aux. Counter at Max output bit LOW. In example #1, the Aux. Counter Max Counts is set to zero. Therefore, the Aux Counter at Max (SACM) output is disabled.

NOTE: IF END OF STEPPER (EOS) IS PROGRAMMED AS A **FAULT** IN THE SETUP PARAMETERS, THE WELDING WILL STOP AND REQUIRE A FAULT RESET AT EVERY WELD TO WORK THROUGH THE PART.

STEPPER STATUS

The Stepper Status screen is one of the most viewed displays. It gives the operator a quick indication of the following:

- Stepper Assignment - On or Off
- Step Number
- Step Weld Count
- Boost %
- Total Weld Count
- Remaining Tip Dresses
- Stepper Aux. Count
- The current Stepper #

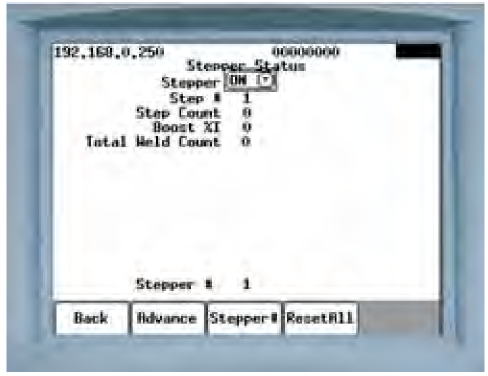
TO ACCESS THE STEPPER STATUS SCREEN FROM THE HOME MENU ON THE DEP-300S PERFORM THE FOLLOWING STEP:

① Press 

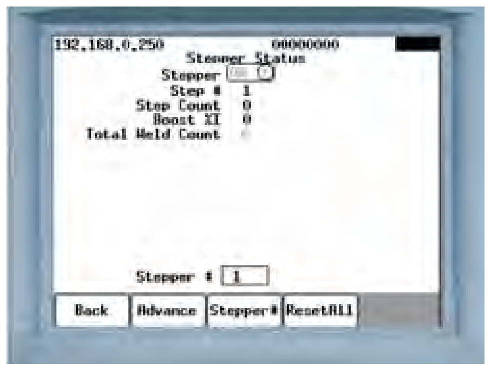
Status Mode.

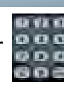
② Press 

Stepper Status.



③ Press  Stepper#.



④ Enter Stepper Number .

⑤ Press  ENTER.

THE FOLLOWING CHART DESCRIBES THE PARAMETERS, WHICH APPEAR ON THE STEPPER STATUS MENU:

PARAMETER	DESCRIPTION
STEPPER	Turns the stepper either ON or OFF. The default position is ON.
STEP #	The step number the stepper program is currently in (1 through 5)
STEP COUNT	The weld count within the step, the stepper program is currently in.
BOOST% I	The current boost being applied to each weld. **NOTE:** IF A PERCENTAGE OF AVAILABLE VOLT-SECONDS WELD FUNCTION IS USED, THIS VALUE WILL BE DISPLAYED AS A PERCENTAGE. CONVERSELY, IF A CONSTANT CURRENT WELD FUNCTION IS USED, THIS VALUE WILL BE DISPLAYED IN ABSOLUTE AMPS.

PARAMETER	DESCRIPTION
TOTAL WELD COUNT	The total weld count since the beginning of the stepper program.
TIP DRESSES	The Remaining Tip Dresses Count is a decrementing counter, which starts at the number entered in GROUP (1-99) MAXIMUM TIP DRESSES in the stepper program. This counter defines the maximum number of times the weld caps may be dressed before they must be changed. Each time the weld processor receives a tips dressed index, the Remaining Tip Dresses Count decrements by one. When this count decrements to zero, a TIP CHANGE REQUIRED - TCR/TCG1/ TCG2 output is generated. This indicates the weld caps must be changed.
AUX. COUNTER	The Auxiliary Counter is an incrementing counter, which mirrors the Total Weld Count counter above. Its max count is set by the value entered in the Aux Counter Max Counts parameter in the stepper profile.
STEPPER #	The stepper program number currently displayed. Pressing the Stepper # (F3) key, allows the user to change the stepper program that is displayed. (1-10)
ADVANCE	Pressing the Advance (F2) key, advances the stepper program to the first weld of the next step. When the stepper advances, the following changes will occur in the Stepper Status Menu: • The **STEP COUNT** will reset to zero. • The **TOTAL WELD COUNT** will advance to where its count would be at the first weld of the next step. • The Aux. Counter will not change when the stepper is advanced. If the user wants the Aux. Counter count to match the Total Weld Count, the value will have to be manually entered here.
RESET ALL	Pressing the Reset ALL (F4) key, globally resets all stepper programs.

STEPPER RESET OPTIONS

An END OF STEPPER FAULT indicates the stepper program has ended. At this point, the weld caps must be replaced on the gun and the stepper program(s) must be reset. Stepper Reset changes all counts within the stepper program back to their beginning value. See example below.

In weld processor software A15X50, there are two ways in which the user can reset stepper programs:

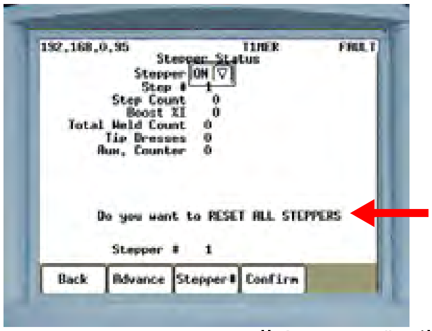
OPTION 1: GLOBAL STEPPER RESET (I/O)

Stepper programs can be globally reset by pressing the Reset ALL (F4) button in the Stepper Status Menu. When this is done, all 10 stepper programs are reset, regardless of what group they are assigned to. The user needs to be cautious to only use this method if they are absolutely certain they want to globally reset every stepper program within the weld processor simultaneously.

PERFORM THE FOLLOWING STEPS FROM THE DEP-300S STEPPER STATUS MENU TO GLOBALLY RESET THE STEPPER PROGRAMS:

① Press 

Reset ALL.



② The message “Do you want to reset all Steppers” will appear.

③ Press 

Confirm.

OPTION 2: GROUP STEPPER RESET (I/O)

Stepper programs assigned to either Group 1 or Group 2 can be reset as a group. When the Stepper Reset Group 1 input bit is turned HIGH, all the stepper programs assigned to Group 1 will be reset. Likewise, when the Stepper Reset Group 2 input bit is turned HIGH, all the stepper programs assigned to Group 2 will be reset.

THE FOLLOWING OCCURS AT STEPPER RESET:

- STEPPER APPROACHING MAX ALERT is reset.
- END OF STEPPER FAULT is reset.
- All counts within the stepper program are changed back to their beginning value, including tip dresses remaining.

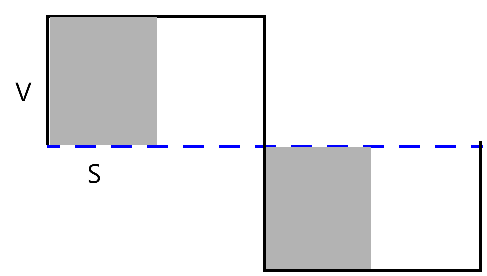
NOTE:

PRESSING THE FAULT RESET BUTTON ON THE DEP-300S WILL ONLY RESET THE STEPPER APPROACHING MAX ALERT AND THE END OF STEPPER FAULT. IT DOES NOT RESET THE STEPPER PROGRAM(S)

Chapter 9: ADVANCED TOPICS

PERCENT OF AVAILABLE VOLT-SECONDS WELDING MODE

Percent of Available Volt-Second (%VS) welding can be viewed as a way of accomplishing AVC control in an MFDC inverter. In the example below, “S” (IGBT on-time) is adjusted to keep the effective voltage applied to the welding transformer constant. So, if the DC bus voltage goes higher, the IGBT's shut off earlier. Conversely, if the DC bus voltage goes lower, the IGBT's shut off later. This allows the volume of the shaded area to remain constant.



In the above example, let's assume that V=5 and S=4. Then the total shaded area would equal (V x S) or 20. Now suppose that V drops to 4.

Then S would be increased to 5 to maintain a total value of 20 in the shaded area.

NOTE: PERCENT OF AVAILABLE VOLT-SECOND WELDING ONLY KEEPS THE APPLIED VOLTAGE TO THE WELDING TRANSFORMER CONSTANT. CURRENT WILL FLUCTUATE DEPENDING ON VARIATIONS IN THE SECONDARY RESISTANCE.

SETUP

1. To use Percent of Available Volt-Second welding, insert function #20 in the weld schedule. In the example below, the function was programmed to weld at 50% of Available Volt-Seconds for 500 milliseconds.

20	WELD 500 MS. IMP 50% VS

2. Ensure the TRANSFORMER RATED DC VOLTAGE (programmed in the Setup Parameters) is set correctly. This parameter is the rated DC voltage of the welding transformer and can be found on the manufacturer's label affixed to the welding transformer. In the example below, the parameter is to 680V.

TRANSFORMER RATED DC VOLTAGE: 680

In this example, the weld function is programmed at 50% of the Transformer Rated DC Voltage (680V). Therefore, the effective voltage applied to the welding transformer will be 340V for 500 ms.

APPLICATION

It may be desirable to use Percent of Available Volt-Second welding instead of Constant Current welding in any application where extreme resistance changes occur during normal welding operations. Such applications may include:

- Projection Welding
- Butt Welding
- Flash-Butt Welding
- Aluminum Welding
- Welding through Sealant
- Poor Metal Fit-up / Gaps

You may also use a Percent of Available Volt-Second weld function in conjunction with a Constant Current weld function. For example, if you are welding through sealant, you may want to use a %VS up-slope or preheat weld function to displace the sealant and then form the weld nugget using a Constant Current weld function, for example:

40	SLOPE 500 MS. 20%VS TO 50%VS
30	WELD 500 MS. 10000 AMPS

CONSTANT CURRENT WELDING MODE

Constant Current welding is a method of keeping the current applied to the welding transformer constant, regardless of variations in secondary resistance, during normal welding operations.

To use Constant Current welding, insert function #30 in the weld schedule, for example:

30	WELD 500 MS. 10000 AMPS

In this example, 10,000 Amps target current is programmed into the weld function. The weld processor calculates secondary current by measuring the primary current at the output of the MFDC inverter and multiplying it by the transformer turns ratio (programmed in the Setup Parameters). If the calculated secondary current is less than the target current, the IGBT's shut off later. Conversely, if the calculated secondary current is greater than the target current, the IGBT's shut off earlier. This allows the current applied to the welding transformer to remain constant.

PERCENT OF AVAILABLE CURRENT USED

This parameter, viewed in the Weld Data Screen (%I) is the percentage of the theoretical maximum current of the inverter during the last weld. For example, if the inverter is rated for 600A and the transformer turns ratio is 72:1, then the theoretical max current of the inverter is 43,200A. If the target current during the last weld was 21,600A, then %I = 50.

NOTE: THE TRANSFORMER TURNS RATIO SETUP PARAMETER MUST BE SET CORRECTLY.

NOTE: THIS PARAMETER CAN EXCEED 100%IF THE INVERTER IS OPERATING IN THE “S-CURVE” RANGE. SPECIAL TIMER SOFTWARE IS REQUIRED.

C-FACTOR

C-Factor (or Capacity Factor) is a parameter, which is used to track changes in the weld tooling. C-Factor is calculated by determining the amount of total capacity utilized to create the target current and dividing this value by the actual current created.

The C-Factor feature can be used as a maintenance tool to monitor the following:

- Weld tooling degradation
- Current shunting paths (primary or secondary)

C-Factor is calculated by the weld processor after each weld and is displayed in the Weld Data Display of the DEP-300s.

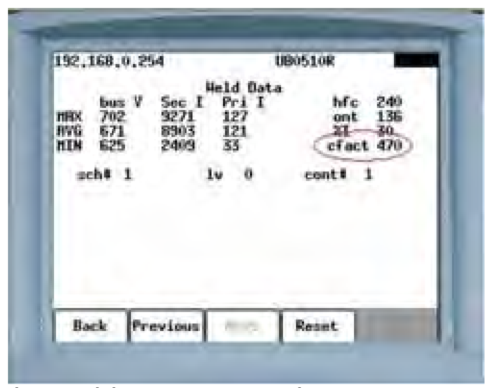
PERFORM THE FOLLOWING STEPS ON THE DEP-300S TO NAVIGATE TO THE WELD DATA MENU.

① Press C F3 Status Mode.

② Press E F5 More.

③ Press  Weld Data.

④ Press  ENTER.



Example of the Weld Data Menu. The C-Factor parameter is circled in red.

DECREASING C-FACTOR

As the weld tooling degrades over time, its resistance (either primary or secondary) increases. As the resistance increases, the weld control must compensate for this change, otherwise the welds will gradually grow colder. Weld tooling degradation can be caused by the following conditions:

- Frayed or undersized (MCM) welding cables.
- Welding cables too long for application.
- Broken or undersized leaf shunts.
- Loose hardware connections.
- Incorrect hardware (mild steel i. stainless steel).

- Incorrect weld caps for application.
- Lower tip pressure.

As the resistance of the weld tooling gradually increases, the weld control gradually increase its “on-time” (or use more of its available capacity) to deliver the requested target current. This gradual decrease in available capacity of the weld control is reflected by a gradually decreasing C-Factor parameter.

INCREASING C-FACTOR

Current shunting (either primary or secondary) is essentially an unintended, alternate path of current flow occurring in the weld tooling. Current shunting causes the overall resistance of the weld tooling to decrease. As current is shunted across the alternate path, less current passes through the work piece, resulting in colder welds. Secondary current shunting paths can be caused by the following conditions:

- Cable shorts to weld tooling or part.
- Weld expulsion (slag) build-up around the hinge of the weld gun
- Higher tip pressure
- Cooling water conductivity issues

As the resistance of the weld tooling gradually decreases, the weld control gradually decrease its “on-time” (or uses less of its available capacity) to deliver the requested target current. This gradual increase in available capacity of the weld control is reflected by a gradual increase in the C-Factor parameter.

C-FACTOR SETUP

Prior to using the C-Factor feature, it is important to establish a reference C-Factor parameter for a known good weld tool. After completing several test welds, record the C-Factor parameter displayed in the Weld Data Menu of the DEP-300s for future reference.

Insert function #92 (C-FACTOR LIMIT: HI= nnnn LOW= nnnn) near the beginning of the weld schedule. See example schedule below:

NOTE:

FUNCTION #92 MUST BE INSERTED IN THE WELD SCHEDULE BEFORE FUNCTIONS #30 (WELD NNNN MS. NNNN0 AMPS) AND #85 (PROCESS WELD FAULTS).

FUNCTION #	FUNCTION NAME
00	START OF SCHEDULE # 1
82	LINEAR STEPPER #1 ASSIGNED (0=0FF)
92	C-FACTOR LIMIT: HI= 220 LOW= 150
76	SEC. CURRENT LIMITS: HI=00 LOW= 99990
81	TRANSFORMER TURNS RATIO 73:1
88	TURN ON ISOLATION CONTACTOR
58	TURN ON WELD IN PROGRESS
01	SQUEEZE 30 CYCLES
30	WELD10 CYCLES. 10000 AMPS
85	PROCESS WELD FAULTS
03	HOLD 5 CYCLES.
63	TURN ON WELD COMPLETE
59	TURN OFF WELD IN PROGRESS
75	EXTEND UNTIL NO INITIATE
64	TURN OFF WELD COMPLETE
89	TURN OFF ISOLATION CONTACTOR
100	END OF SCHEDULE # 1

CALCULATE THE C-FACTOR HI / LOW LIMIT VALUES:

NOTE: THE FOLLOWING INSTRUCTION PROVIDES A STARTING POINT FOR THE C-FACTOR HI / LOW LIMITS. THESE VALUES WILL REQUIRE ADJUSTMENT AS THE USER BECOMES MORE FAMILIAR WITH THE WELD TOOLING AND WHAT THE C-FACTOR PARAMETERS ARE WHEN WELD QUALITY ISSUES OCCUR (CAUSED BY EITHER WELD TOOLING DEGRADATION OR CURRENT SHUNTING).

LOW C-FACTOR LIMIT
The Low C-Factor Limit is used to detect an increase in resistance in the weld tooling, which is caused by cable and connection

HIGH C-FACTOR LIMIT
The High C-Factor Limit is used to detect a decrease in resistance in the weld tooling, which is caused by shunting paths.

SET THE HI AND LOW C-FACTOR LIMIT FAULTS IN THE SETUP PARAMETERS AS FOLLOWS:

FAULT NAME	VALUE
LOW C-FACTOR LIMIT	ALERT
HIGH C-FACTOR LIMIT	FAULT

- Gradual weld tool degradation is an expected process. Therefore, Low C-Factor is set as an ALERT.
- Secondary current shunting is not an expected process and requires immediate attention. High C-Factor is set as a FAULT.

SPC INDEXING CAPABILITIES

SPC (STATISTICAL PROCESS CONTROL) FUNCTIONS

Function #90: SET SPC OFFSET TO nn

For the purpose of statistical data collection, each weld is assigned a data storage bin number (00-99). This function establishes the starting bin number for SPC indexing.

Consider the following example:

CAR TYPE #1	
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	15 Welds Made (Bins 31-48)

CAR TYPE #2	
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	15 Welds Made (Bins 75-88)

After establishing a bin number, the processor stores the data for each weld made in its own individual bin. The bin numbers increase by one each time a weld is made. This will continue until another schedule containing function #90 (SET SPC OFFSET) is executed.

Bin #99 is the last usable bin. if the weld processor 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 WELD PROCESSOR TO COLLECT WELD DATA. IT ONLY ASSIGNS A DATA STORAGE BIN NUMBER. TO SETUP SPC DATA COLLECTION PARAMETERS, SEE SPC SETUP PARAMETERS.

FUNCTION #91: SEND ALL SAMPLES UNTIL NEXT SPC OFFSET

This function is useful to verify tool conditions after a tip-dress operation.

This function tells the weld processor to collect and sample 100% of the weld data within the schedule. it overrides the “global” Data Collection Sample Size and Data Collection Sample Frequency setup parameters, described in SPC Setup Parameters below.

Function #90 (SET SPC OFFSET) should be inserted before #91 in the weld schedule, to ensure the data is sent to the appropriate bin. Otherwise, it will be sent to default bin #0.

The processor will continue collecting and sampling 100% of the weld data within the schedule until the weld processor executes another weld schedule containing function #90 (SET SPC OFFSET). At which point, the “global” Data Collection Sample Size and Data Collection Sample Frequency setup parameters regain their hierarchical priority.

SPC SETUP PARAMETERS

PARAMETER	RANGE
Data Collection Sample Size	1-99
Data Collection Sample Frequency	1-9999

These two parameters set a global command, which allows the weld processor (WCU) to sample data for analysis at controlled intervals.

- The ***sample size*** is the number of consecutive welds collected for analysis (per bin).

- The ***sample frequency*** is the total number of welds, from which the samples are taken from (per bin).

FOR EXAMPLE:

Let's assume function #90 (SET SPC OFFSET) is inserted in the weld schedule and set to bin #1:

90	SET SPC OFFSET TO 01

Let's also assume in the Setup Parameters, the Data Collection Sample Size is set to (2) and the Data Collection Sample Frequency is set to (8):

DATA COLLECTION SAMPLE SIZE: 2
DATA COLLECTION SAMPLE FREQUENCY: 8

By setting the Data Collection Sample Size to (2) and the Data Collection Sample Frequency to (8), the WCU will collect data for the first two consecutive welds (in bin #1) and flag the WebView to retrieve the data. it will then collect data for the six remaining welds (without flagging the WebView) before repeating the process.

THE FOLLOWING TABLE ILLUSTRATES THE EXAMPLE ABOVE:

BIN # 1		
SAMPLE / FREQUENCY	WCU PROCESS	WebView 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

BIN # 1		
SAMPLE / FREQUENCY	WCU PROCESS	WebView PROCESS
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 THE WEB VIEW SEPARATELY.

APPLICATION ERROR CODES

I/O STATUS

To navigate to the I/O Status Menu, perform the following steps on the DEP-300s.

① Press 

Status Mode

Each bit is represented by a tag. Each tag will have either a “1” or “0” underneath it:

- “1” indicates the bit is HIGH or ON.
- “0” indicates the bit is LOW or OFF.

TAG NAME	BIT NAME	BIT TYPE
FACK	APP ERR ACKNOWLEDGE	Input
EVAL	APP ERROR AVAILABLE	Output
ER1	APP ERROR BIT 1	Output
ER2	APP ERROR BIT 2	Output
ER4	APP ERROR BIT 4	Output
ER8	APP ERROR BIT 8	Output
ER16	APP ERROR BIT 16	Output
FERR	FAULT ERROR	Output
AERR	ALERT ERROR	Output

NOTE: For more information on mapping I/O bits, see Chapter 11: Inputs and Outputs.

HOW WTC ERROR CODES ARE REPORTED

The following example is a robot welding application where the weld processor is reporting three application error codes:

ERROR CODE	FAULT FAMILY	WELD CONTROL FAULT	TYPE
5	END OF STEPPER	End of Stepper	FAULT
7	HIGH/ LOW CURRENT LIMIT	Low Current Limit Fault	FAILT
19	C-FACTOR LIMIT	Low C-Factor Limit	ALERT

NOTE: Multiple application error codes are reported in ascending order.

1. When a faults occurs, the **EVAL** output bit goes HIGH and application error code (5) is binarily displayed on the **ER1-ER16** output bits. Since the End of Stepper is configured as a FAULT in the weld processor, the **FERR** output bit will also go HIGH.

2. The HIGH **EVAL** output bit tells the robot to read the **ER1-ER16** and **FERR** output bits.

3. When the robot has read these output bits, it toggles the **FACK** input bit.

4. The toggling **FACK** input bit causes the **EVAL** output bit to toggle. When this toggle occurs, the next application error code (7) is binarily displayed on the **ER1-ER16** output bits. Since the Low Current Limit Fault is configured as a FAULT in the weld processor, the **FERR** output bit will also go HIGH.

5. The toggling **EVAL** output bit tells the robot to read the **ER1-ER16** and **FERR** output bits a second time.

6. When the robot has read the **ER1-ER16** output bits, it toggles the **FACK** input bit.

7. The toggling **FACK** input bit causes the **EVAL** output bit to toggle. When this toggle occurs, the next application error code (19) is binarily displayed on the **ER1-ER16** output bits. Since the Low C-Factor Limit is configured as an ALERT in the weld processor, the **AERR** output bit will also go HIGH.

8. The toggling **EVAL** output bit tells the robot to read the **ER1-ER16** output bits a third time.

9. When the robot has read the **ER1-ER16** output bits, it toggles the **FACK** input bit.

10. The toggling **FACK** input bit causes the **EVAL** output bit to toggle. When this toggle occurs, the weld processor scrolls and re-displays application error code (5) on the **ER1-ER16** output bits. Since the End of Stepper is configured as a FAULT in the weld processor, the **FERR** output bit will also go HIGH.

11. The toggling **EVAL** output bit tells the robot to read the **ER1-ER16** and **FERR** output bits a fourth time.

12. When the robot reads the **ER1-ER16** output bits, it recognizes that it has previously read application error code (5) and the reporting process ends.

APPLICATION ERROR CODES FOR GEN6A TIMER SOFTWARE A15X50

SETUP NO.	FAULT FAMILY	ERROR CODE	APPLICATION ERROR BINARY OUTPUT BITS				
			ER1	ER2	ER4	ER8	ER16
1.	INPUT / OUTPUT ERROR	1	1	0	0	0	0
2.	INPUT / OUTPUT ALARM	2	0	1	0	0	0
3.	INCOMPLETE WELD	3	1	1	0	0	0
4.	STEPPER APPROACHING MAX	4	0	0	1	0	0
5.	END OF STEPPER	5	1	0	1	0	0
6.	SURE WELD TREND LIMIT	6	0	1	1	0	0
7.	HIGH/LOW CURRENT LIMIT	7	1	1	1	0	0
8.	FIRING ERROR	8	0	0	0	1	0
9.	CYLINDER FAULT	9	1	0	1	1	0
10.	CYLINDER ALARM	10	0	1	0	1	0
11.	POWER FACTOR ERROR	11	1	1	0	1	0
12.	COMPENSATION ERROR	12	0	0	1	1	0
13.	INSUFFICIENT LINE VOLTAGE	13	1	0	1	1	0
14.	EXTENDED WELD	14	0	1	1	1	1
15.	ISOLATION CONTACTOR ERROR	15	1	1	1	1	0
16.	WELDING BUS VOLTAGE	16	0	0	0	0	1
17.	WELD DATA NOT PROGRAMMED	17	1	0	0	0	1
18.	ANALOG PRESSURE ERROR	18	0	1	0	0	1
19.	C-FACTOR LIMIT	19	1	1	0	0	1
20.	EXTERNAL SENSOR	20	0	0	1	0	1
21.	WELDING TRANSFORMER	21	1	0	1	0	1
22.	OVER TEMPERATURE	22	0	1	1	0	1
23.	SHORTED SCR	23	1	1	1	0	1
24.	INTERNAL TIME ERROR	24	0	0	0	1	1
25.	INVERTER FAULT	25	1	0	0	1	1
26.	WELDING ERROE	26	0	1	0	1	1

FAULT FAMILY CROSS-REFERENCE TO WTC WELD CONTROL FAULT(S)

ERROR CODE	FAULT FAMILY	WTC WELD CONTROL FAULT(S)
1	**INPUT / OUTPUT ERROR**	• INVALID SEQUENCE SELECTED • WELD PROCEED • PRESSURE SWITCH • IO • INITIATION ON POWER-UP • RETRACT PILOT • SECONDARY CURRENT SENSOR • WELD INTERRUPTION
2	**INPUT / 0UTPUT ALARM**	• WELD INITIATE NOT PRESENT • CONTROL IN NO WELD
3	**INCOMPLETE WELD**	• CONTROL STOP • WELD INTERRUPTION
4	**STEPPER APPROACHING MAXIMUM**	• STEPPER APPROACHING MAX
5	**END OF STEPPER**	• END OF STEPPER
7	**HIGH / LOW CURRENT LIMIT**	• HIGH CURRENT LIMIT FAULT • LOW CURRENT LIMIT FAULT
12	**COMPENSATION ERROR**	• SOFT OVERCURRENT • CURRENT REGULATION
13	**INSUFFICIENT LINE VOLTAGE**	• CONTROL TRANSFORMER VOLTAGE • LOW LINE VOLTAGE • AC LINE PHASE
14	**EXTENDED WELD**	• EXTENDED WELD • EXCESSIVE REWELD
15	**ISOLATION CONTACTOR ERROR**	• ISO CNTR OFF WHEN NEEDED • ISO CNTR ERR BRKR TRIPPED
19	**C-FACTOR LIMIT**	• HIGH C-FACTOR LIMIT • LOW C-FACTOR LIMIT
21	**WELDING TRANSFORMER**	• SECONDARY DIODE • GROUND
22	**OVER TEMPERATURE**	• SYSTEM COOLING • TEMPERATURE

ERROR CODE	FAULT FAMILY	WTC WELD CONTROL FAULT(S)
25	**INVERTER FAULT**	• IGBT SATURATION • IGBT POWER SUPPLY • BUS VOLTAGE • BUS CHARGING

TIP DRESS SCHEDULE SETUP

STANDARD TIP DRESS SCHEDULE

The following is an example tip dress schedule when the weld control is not controlling the tip dress motor.

FUNCTION #	FUNCTION NAME
00	START OF SCHEDULE # 1
58	TURN ON WELD IN PROGRESS
01	SQUEEZE 30 CYCLES
93	TIP DRESS ADVANCE: GROUP 1 - STEP 2
59	TURN OFF WELD IN PROGRESS
63	TURN ON WELD COMPLETE
03	HOLD 5 CYCLES
51	TURN OFF WELD COMPLETE
100	END OF SCHEDULE # 1

TIP DRESS CHECK SCHEDULE

The following is an example tip dress schedule where the weld control is controlling the tip dress motor. This feature requires an optional tip dress motor control circuit installed in the weld control cabinet (see note below). This schedule also monitors or "checks" the current draw of the tip dress motor.

The purpose of this check is to:

- Protect the motor from damage
- Determine if the weld caps were properly cut.

NOTE: If your weld control cabinet does not have the optional motor control circuit installed and you are interested in using this feature, contact your WTC sales representative for assistance.

FUNCTION #	FUNCTION NAME
00	START OF SCHEDULE # 1
16	MOTOR CURRENT LIMITS HI =6000 ma LO = 1000 ma
58	TURN ON WELD IN PROGRESS
18	START TIP DRESS MOTOR CHECK
17	TIP DRESS TIME 5 SEC BLANK 500 ms
19	STOP TIP DRESS MOTOR CHECK
59	TURN OFF WELD IN PROGRESS
63	TURN ON WELD COMPLETE
03	HOLD 5 CYCLES
51	TURN OFF WELD COMPLETE
100	END OF SCHEDULE # 1

DESCRIPTION OF THE SPECIAL FUNCTIONS (IN RED ABOVE) USED IN THE TIP DRESS CHECK SCHEDULE:

Function #16 (MOTOR CURRENT LIMITS HI =nnnn ma LO =nnnn ma) sets the HIGH and LOW current limits for the tip dress motor current being measured.

Function #18 (START TIP DRESS MOTOR CHECK) tells the weld processor to turn the tip dress motor ON.

NOTE: This function must be inserted in the schedule after function #16 (MOTOR CURRENT LIMITS HI =nnnn ma LO =nnnn ma).

Function #17 (TIP DRESS TIME nn SEC BLANK nnnn ms) sets the total amount of time (in seconds) the tip dress motor is ON. The blanking time (in milliseconds) is the period of time the weld processor does not measure the motor starting (in-rush) current.

NOTE: This function must be inserted in the schedule after function #18 (START TIP DRESS MOTOR CHECK) and before function #19 (STOP TIP DRESS MOTOR CHECK).

Function #19 (STOP TIP DRESS MOTOR CHECK) tells the weld processor to turn the tip dress motor OFF.

MODE OF OPERATION:

1. After the blanking time, the motor current is checked every 8ms until either a function #19 (STOP TIP DRESS MOTOR CHECK) is reached or a fault occurs.
2. If the measured motor current is above the LOW limit for 1 or more seconds of accumulated time, the tip dress is considered good.
3. If the measured current is above the LOW limit for less than 1 second of accumulated time, a TIP DRESS FAULT is generated. Probable causes include:

- Insufficient gun pressure on the cutting blades.
- Weld caps did not come in contact with cutting blades (no load on motor).
- Improper weld cap fit-up on the cutting blades.

4. If the measured motor current is above the HIGH limit any time during the 8ms checking period, the motor is immediately turned off and a HI / NO MOTOR CURRENT FAULT is generated. Probable causes include:

- Motor stall caused by a mechanical failure in the cutting head.
- Motor stall caused by a Jam in the cutting blades.
- Too much gun pressure on the cutting blades (excessive load on motor).

5. If the measured current is <=20ma any time during the 8ms checking period, the motor is immediately turned off and a HI / NO MOTOR CURRENT FAULT is generated. Probable causes include:

- Motor did not turn on (motor starter relay did not energize).
- Current feedback coil did not measure any current (loose/ open wire).

NOTES:

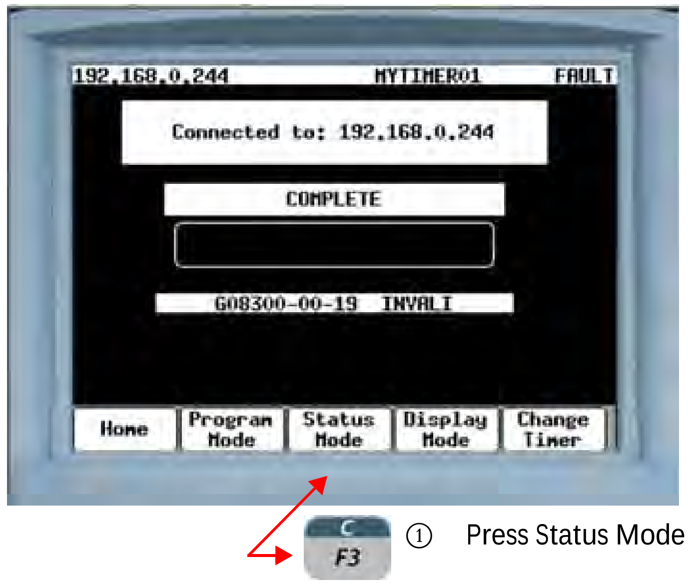
① The Tip Dress Time includes the Blanking Time. Therefore, If the Tip Dress Time minus the Blanking Time is less than 1 second, a TIP DRESS FAULT will occur.

② As a good starting point:
Tip Dress Time = Blanking Time + 1010ms (1.01 sec). The idea is to ensure the time the motor current is actually being measured is greater than 1 second (1 second = 1000ms).

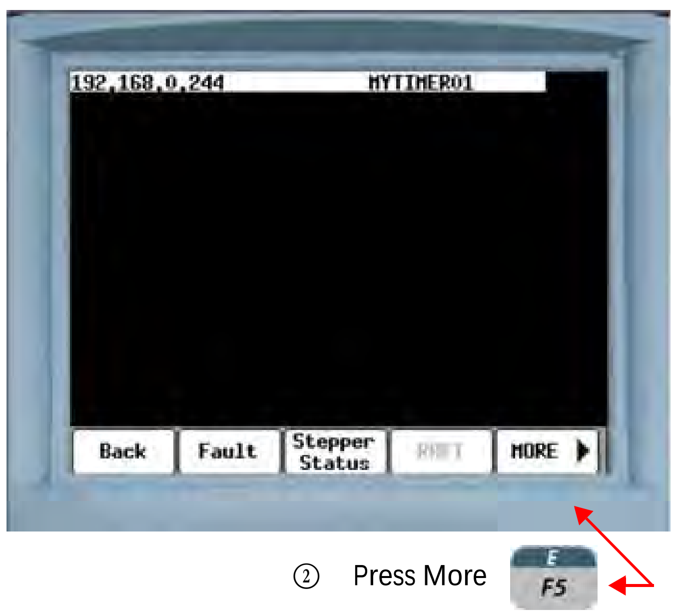
③ Set properly, the Blanking Time prevents erroneous HIGH / NO MOTOR CURRENT FAULTS from occurring, caused by the motor starting (in-rush) current. The Blanking Time will vary depending on the design specifications of the motor being used. The idea is to blank-out (or not measure) the motor starting (in-rush) current.

MOTOR CURRENT MEASUREMENT RESULTS

The results of the tip dress motor current check are displayed in the Weld Data Menu. Perform the following steps on the DEP-300s to navigate to the Weld Data Menu.



① Press Status Mode



② Press More

③ Press Weld Data

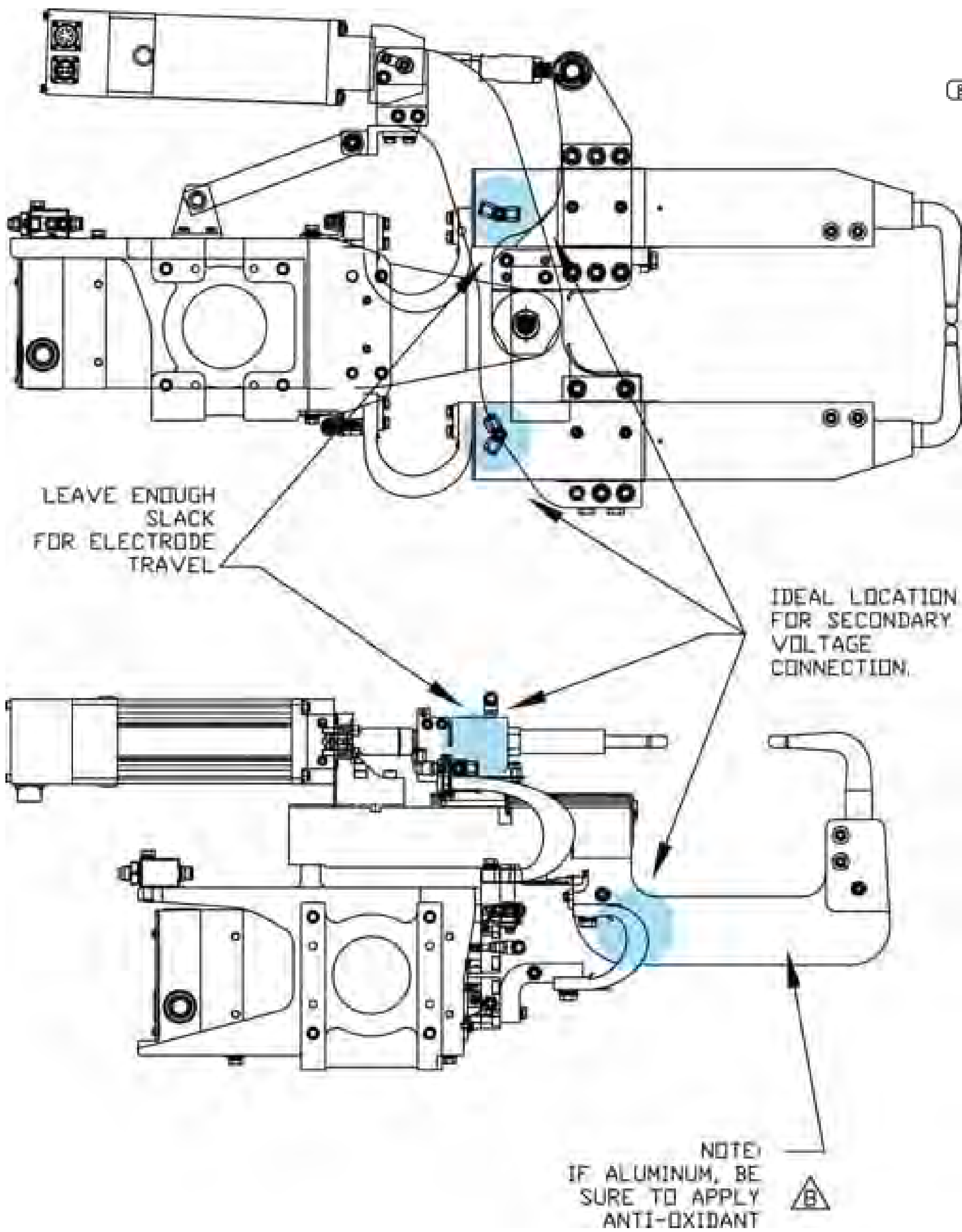
Chapter 10: *RAFT™* (Resistive Adaptive Feedback Technology)

RAFT™ HARDWARE INSTALLATION

In order to use the ***RAFT***™ adaptive welding, the installation of voltage sense wires between the gun tips and the weld control cabinet are required. Stainless steel terminals, cables and fasteners are used at the weld gun to minimize cable failure caused by snagging and wear due to gun and wrist movement. On a typical robot installation, stainless steel cables are installed from the gun back to the robot arm/wrist. At that point, the stainless steel cables are terminated to a two-conductor copper cable (shielding is optional). The two-conductor copper cable continues back to the weld control cabinet, where it is terminated at the weld processor.   Service connections can be made for easier cable replacement but no more than 5 connections are recommended. The use of the copper cable is a cost effective alternative to running stainless steel cable all the way back to the weld control cabinet.

***RAFT*™ VOLTAGE SENSE WIRE INSTALLATION KIT**

WTC OFFERS A STAINLESS STEEL VOLTAGE SENSE WIRE INSTALLATION KIT. THE PART NUMBER IS 830-0970. THIS KIT INCLUDES ALL REQUIRED HARDWARE, DRAWINGS AND DOCUMENTATION. FOR MORE INFORMATION, CONTACT YOUR WTC SALES REPRESENTATIVE.



- Place the wires near the water ports located on the welding gun arms. This area is ideal since it is unlikely to get damaged over time and the resistance will be constant.
- The secondary voltage tip wires are required to be installed before the cap adapter and after the leaf shunts. The leaf shunts will break over time changing their resistance which will adversely effect the feedback signal.

NOTE: *This drawing is a general guide for installation. Specific installation is the responsibility of the customer*

NOTE: The placement of the Tip Wires is a balance of determining points where the resistance will not change over time and placing the wires at a point where they will not get damaged over the life of the tool.

Clean installation point with an Emery Cloth to allow the tip wire to make good contact with the surface of the weld arm.

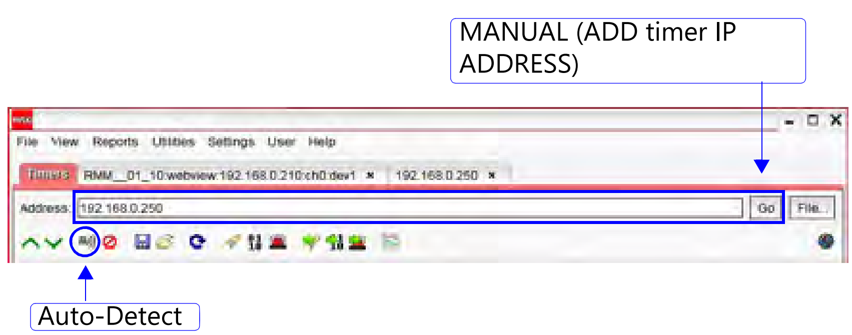
CONNECTING TO WELD CONTROLS

Figure 10.1 Timer Status Screen

On startup, the ***RAFT***™ Gateway program opens to the Timer Status screen shown above. The "Timers" tab on this screen gives the operator a view of all timers the program has been directed to connect with and status of the connections. The Timers screen is the main screen of the ***RAFT***™ Gateway interface. This screen gives the operator an entire view of all the weld controls and their current status. The Timer Screen is where weld timers are added (either automatically or manually) to the network for data collection. Once a timer is added, the control status is constantly updated, allowing the user to view and correct faults as they occur.

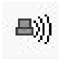
In this screen above, the list is empty because "Auto-Detect Timers" has not been clicked and no list has been saved in the INI file.

There are two methods to add a weld control timer to the timer Timer screen:



1. AUTO-DETECT METHOD:

The easiest way of adding weld timers to the list is by using the Auto-Detect feature.

Clicking  initiates a search for all active WTC timers on the network, (within the same subnet mask), reads their status, and adds them to the main timer list. “Online,” “OK,” “Fault” or “Alert” will appear in the Status column. (If “Offline” appears it indicates a previously established timer connection is not communicating.) At this point, other than status collected during the search scan, no real time data is being communicated.

Once connected, the weld timer(s) will be displayed on the ***RAFT***™ Gateway's weld timers list view as shown below.

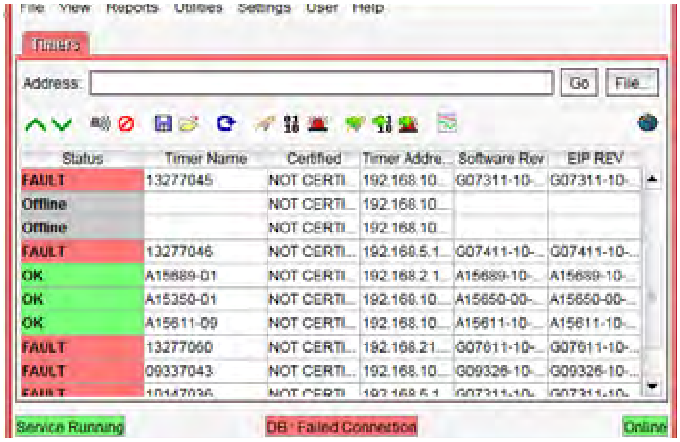


Figure 10.2 Timer Status Screen

TIMER STATUS SCREEN ICONS EXPLAINED:

ICON	NAME	DESCRIPTION
	**AUTO-DETECT TIMERS**	Detects all active WTC weld timers on the network (within the same subnet mask) and populates the main timer list.
	**REMOVE TIMERS**	Removes the selected weld timer(s) from the main timer list.
	**SAVE TIMER LIST**	Saves the entire main timer list to the raftgateway.ini file. When a new timer is added to the interface, the save button turns from gray to yellow to alert the user that there are differences between the raftgateway.ini file and the current on-screen list. Clicking the save button in the yellow state will save the current on-screen list to the raftgateway.ini file. After the save is complete, the button will turn back to gray.

ICON	NAME	DESCRIPTION
	**LOAD TIMER LIST**	Loads the raftgateway.ini file to the timer list. If a weld timer was deleted from the timer list (and the Save button was not pressed), this button can be used to re-load the timer list as it was last saved to the raftgateway.ini file.
	**REFRESH**	Refreshes the status of the weld timer(s) on the main timer list to ensure the information viewed is current.

IF WELD CONTROLS DO NOT SHOW UP ON THE LIST WHEN THE AUTO-DETECT BUTTON IS PRESSED, VERIFY THE FOLLOWING:

1. Verify power to the weld timer.
2. Ping the weld control via the EtherNet network.
3. Verify that the EtherNet cables are properly connected and in the correct port.
4. Verify the workstation computer is assigned same Subnet Address as the weld timer.
5. Verify with your network administrator that TCP/IP or UDP traffic is not blocked.

2. MANUAL METHOD:

To manually add a weld timer to the Main Timer Screen, type the IP Address of the weld timer into the Address Bar and then click GO.

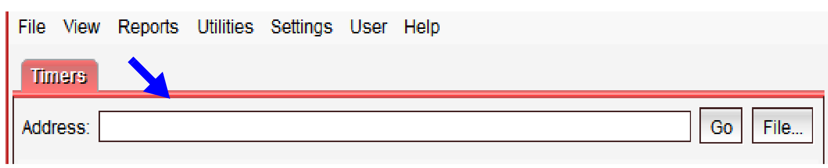


Figure 10.3 Timer Status Screen showing blank address window.

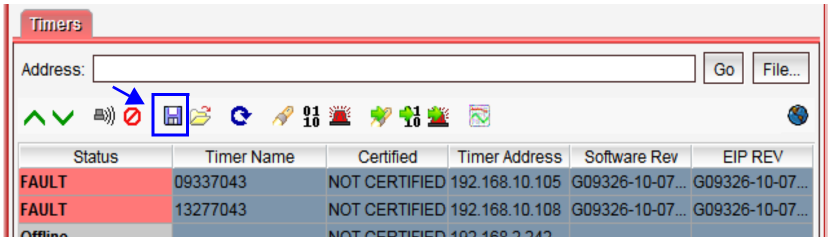
When the ***RAFT™*** Gateway attempts to connect to a weld timer, an internal timer starts counting in the subscription process. If the internal timer expires before a successful connection with the weld timer is established, the timer will still be added to the timer list, but with an "OFFLINE" status. If a successful connection with the weld timer is established, the status will change to "ONLINE". Pressing the Refresh button will automatically reconnect and verify the state of all weld timers in the timer list.

A WARNING MESSAGE WILL APPEAR IF THE ***RAFT™*** GATEWAY ATTEMPTS TO CONNECT TO A WELD TIMER IP ADDRESS THAT IS OUTSIDE OF THE SUBNET MASK OF THE WORKSTATION PC. DEPENDING ON THE NETWORK CONFIGURATION, THE POTENTIAL EXISTS TO ALTER A WELD TIMER OUTSIDE OF YOUR PHYSICAL LOCATION.

For additional instructions on using ***RAFT™*** Gateway, refer to Manual M-038151_V4.0

SAVING TIMERS TO THE .INI FILE.

Once the timer status list has been populated with all available timers in the network, (using either Auto-detect or Manual method to connect, the list can be saved to the .ini file.



To save the timers to the INI file, hold down the Shift key on your keyboard left click your mouse to select the timers.

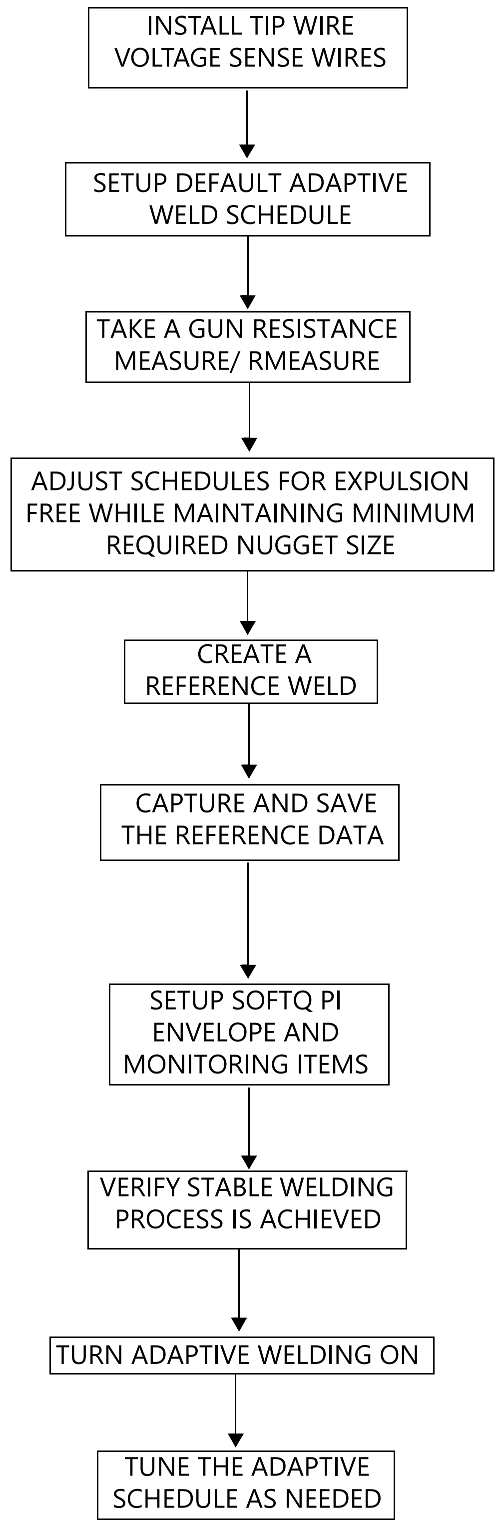
Then click the -"Save timer list to INI file" icon.

When opened, after the initial launch process, the ***RAFT***™ Gateway program populates the "Timers" list from a special file with extension .ini, (INI file), and attempts to establish communications to all weld timers in the list per parameters stored in the file. Real time status and event data for newly detected or manually added weld timers will not be sent or received until the necessary parameters are saved in the INI file and transmitted to the appropriate weld timer during ***RAFT***™ Gateway service startup.

NOTE:

SOFTWARE A15671 SUPPORTS ALL ***RAFT***™ FUNCTIONALITY. CALL YOUR WTC ASSOCIATE TO DETERMINE IF YOUR SPECIFIC WELD CONTROL HARDWARE IS ***RAFT***™ CAPABLE.
PHONE: 248-477-3900 FAX: 248-477-8897
EMAIL: SERVICE@ELDTECHCORP.COM

RAFT™ SET-UP PROCESS AT A GLANCE



PERFORMING A GUN RESISTANCE MEASUREMENT

RAFT™ requires a weld gun resistance measurement (R Measure) to be performed prior to turning on adaptive welding. This is established by performing a Resistance Measure tip to tip weld. Up to four guns can be used with a gun changer per timer.

To perform an R Measure, a tip to tip weld (without metal) is made for 200ms or 12 cycles at 10K amps and at a tip force of 600lbs.

On a ***non tip dressing*** weld application the R Measure is performed with brand new tips.

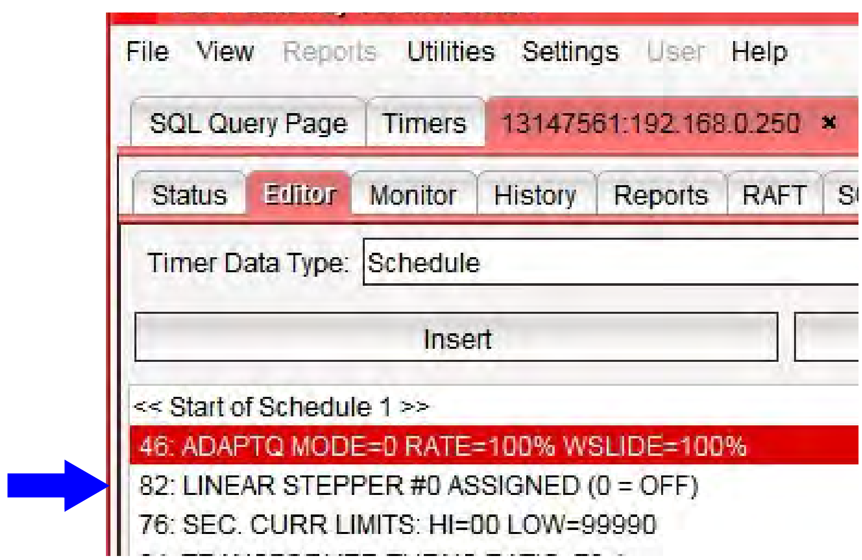
On a ***tip dress*** application where the tips are dressed immediately after changing the weld caps, the R Measure is performed on a dressed tip.

① Setup a simple constant current weld schedule. See sample schedule below:

- If function (ADAPTQ MODE=0 RATE=nnn% WSLIDE=nnn%) is inserted in the schedule, ensure the mode is set to 0 (OFF). This puts the weld control in Constant Current Mode.
- Recommended weld current range: 10, 000 Amps.
- Recommended weld time range: 12 CY / 200 Msec.).

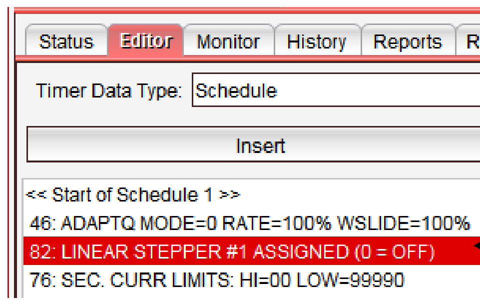
WARNING!

IF APPLICATION REQUIRES EITHER THE LINEAR STEPPER FUNCTION TO BE TURNED OFF (0=OFF) OR THE STEPPER GROUP NUMBER TO BE CHANGED, A NEW R MEASURE PROCEDURE MUST BE PERFORMED TO ENSURE THE CORRECT R MEASURE DATA IS STORED IN THE NEW STEPPER GROUP.

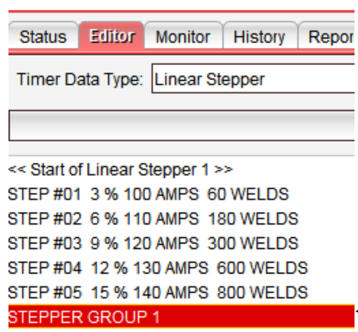


- The R Measure for the specific weld gun data is stored based on the stepper group that is associated with the schedule. Therefore, ensure the linear stepper function is inserted into the schedule and the correct linear stepper and group numbers are assigned for the application.

NOTE: IF A TIP DRESSER IS BEING USED, DRESS THE WELD CAPS PRIOR TO PERFORMING THE R-MEASURE WELD.



Assign the correct Stepper number in the weld schedule



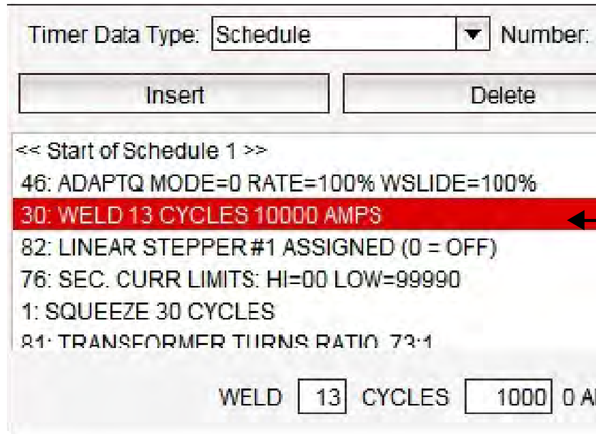
Assign the correct Group number in the stepper profile

For portable gun welding applications:
Gun1 = (Stepper #1 / Group #1)
Gun2 = (Stepper #2 / Group #2)

REFERENCE TABLE

WELD GUN #	ASSIGN STEPPER #	ASSIGN GROUP #
1	1	1
2	2	2
3	3	3
4	4	4

Example: If only one gun is used, assign Stepper #1 to all weld schedules and assign Group #1 to Stepper #1.



Program the weld function in the weld schedule for 200ms or 12 cycles at 10K amps.

② Set gun force as required for the welding application.

- Recommended force range: 600 lbs. / 2.7 kN

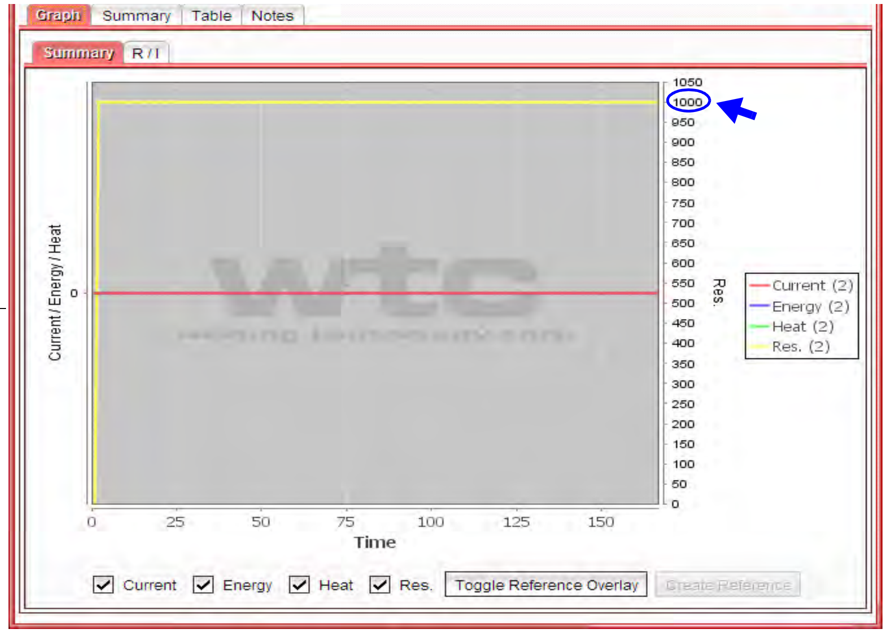
③ Install new weld caps on the gun or dress the caps depending on the application.

④ Verify that 2.7kN or 600 lbs. of force will be present at tips when the weld schedule is initiated.

⑤ Reset Steppers.

⑥ Initiate the weld schedule and verify that the R Avg. (Resistance Average) value is between 30 and 150 micro-ohms. (Ex. R Avg. 52 micro-ohms). Repeat 2-3 times and ensure the R Avg. value is stable.

If the R Avg is 1000 Micro-ohms, the polarity of the tip wires is incorrect at the weld timer. Swap the tip wires at the weld timer (Pins 1&2 of the SEC I/V connector)



⑦ On the Weld Status Screen, click the R Measure toggle button from “R Measure is OFF” to “R Measure is ON”. See example below.

When to perform a new R measure?
▶ *The voltage wire termination points on the weld gun are changed.*
▶ *New gun arm or new gun is installed.*
The R Measure does not need to be performed if weld caps, weld adapters, or leaf shunts are changed.

⑧ Close the weld gun tip-to-tip, and initiate the weld sequence. When the sequence is complete, the R Measure toggle button will automatically switch from “R Measure ON” to “R Measure OFF”.

The Gun Resistance Measurement has now been established and the R Measure weld procedure is complete. R Measure is enabled for only one weld and then turns off automatically. ***RAFT***™ stores the R Measure data in the Offset Resistance Data section of the timer program. Users cannot edit this data, but they can see it by running a “Current Timer Data Report” in the Reports tab.

REFERENCE WELD

After establishing the R Measure, the next step in the ***RAFT***™ Gateway procedure is setting the Reference weld.

A reference weld is the stored Constant Current (CC) weld data set that AdaptQ™ compares the weld in process to.

The reference weld cannot have any expulsion.

A proper reference weld is:

- Free of weld disturbances (gaps, misaligned or worn tips, edge welds, gun to metal misalignment, etc.)
- The reference weld nugget size is at user determined standard (Plant Standards) or slightly above.
- The Resistance curve shapes are smooth instead of sharp inclines or declines.
- “Resistance Drop” desired ranges are 15.0 to 50.0, depending on the metal stack-up.

To optimize ***RAFT™***, each spot must be assigned to a unique weld schedule. Each time a new reference weld is stored, a stepper reset is required before the schedule is placed in Adaptive Mode.

NOTE: WHEN TAKING A REFERENCE WELD THE CURRENT BOOST IN THE STEPPER PROGRAM SHOULD BE TEMPORARILY SET TO 0 AMPS. THIS PREVENTS IMPROPER REFERENCES BY RESTRICTING THE ADDITION OF CURRENT TO THE CORE WELD SCHEDULE BY THE STEPPER.

How to take Reference weld for Adaptive welding:
A reference weld is created by seasoning new/dressed tips with minimum 6-8 welds and no more than 40. A "seasoned" weld tip face produces better results for adaptive referencing.

DATA COLLECTED FROM THE REFERENCE WELD:

▷ **PEAK RESISTANCE (RP)**
The highest resistance value during the weld. (micro-Ohms)

▷ **END RESISTANCE (RE)**
The lowest resistance value after RP. (micro-Ohms)

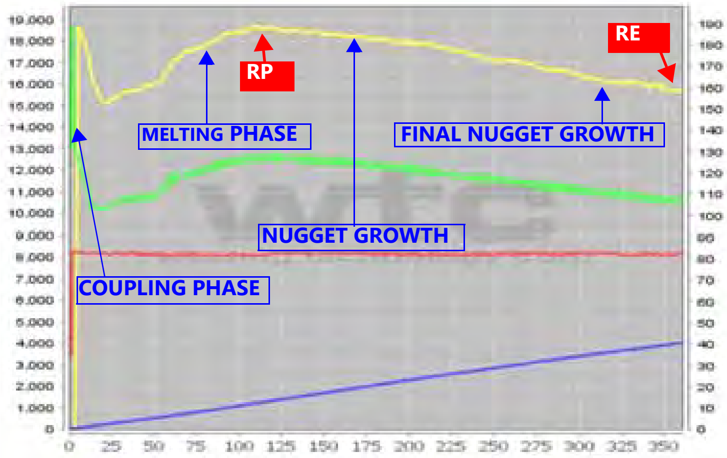
▷ **RESISTANCE DROP (RD)**
The change in resistance from RP to RE. (%)

▷ **TOTAL ENERGY**
The total energy of the weld. (Joules)

▷ **TOTAL HEAT**
The total heat of the weld. (Watts)

▷ **RESISTANCE CURVE**
The values of resistance at tips for every Msec. of the weld.

▷ **CURRENT LEVEL**
The current values for every Msec. of the weld. (Amps)


RE
RP
MELTING PHASE
FINAL NUGGET GROWTH
NUGGET GROWTH
COUPLING PHASE

METHODS TO TAKE A REFERENCE WELD

1. Taking references during a part run.

- Turn “Reference On”.
- Weld the part in Auto.
- Turn “Reference OFF”.

2. Creating a Single Reference.

- Using the last weld while viewing the weld graph in the Status tab.
- While viewing weld data graphs from a weld spot in the History/Graphs/Spot tab.
- When viewing weld graphs from off-line data files in the History/Graphs/Spot tab.

3. Averaging a Reference.

- Averaging multiple weld graphs in the History/Graphs/Spot tab.

4. Duplicating a Reference

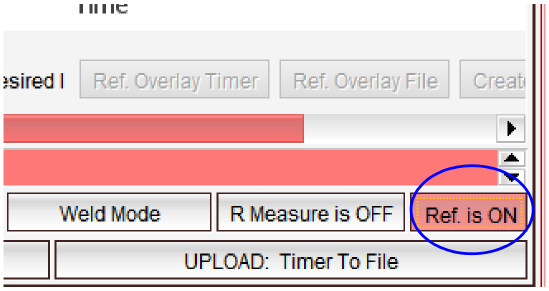
- Duplicate schedule references through the Editor tab.

5. Download a Reference

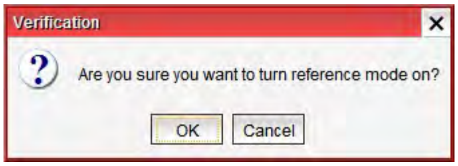
- Download an off line file from the Status tab.

1. TAKING A REFERENCE WELD DURING A PART RUN

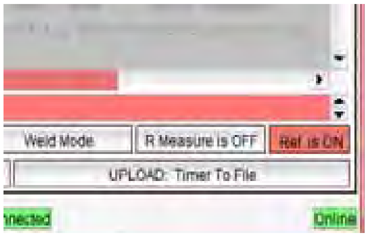
① Left click mouse on the Timer tab that reference welds will be taken on.



② In the Status screen, left click mouse “Ref. is OFF” button which will then change to “Ref. is ON”.



③ A Verification message will be displayed. Click OK.



④ Reference is now turned ON

⑤ Run a part in Auto mode.

ONCE THE “REF. IS ON” BUTTON IS PRESSED AGAIN ONLY THE LAST WELDS MADE WHILE REFERENCE WAS ON WILL BE STORED.

HOW DOES REFERENCE MODE WORK?

Assume that a part has 10 spot welds. Each is assigned an individual schedule #, and the part is run in Reference Mode.

▶ **SITUATION A:**

Ref. is ON and 10 welds are made.
The weld control will fire the schedules in order from 1 to 10. When Ref Mode is turned OFF, these welds will be saved as Reference welds, each with its own schedule.

▶ **SITUATION B:**

Part 1

Schedules 1 to 5 are fired before Ref. Mode is turned ON. Then schedules 6 to 10 are fired.

Part 2

The process is restarted with a new part where all 10 schedules are fired, in order this time. Reference mode is turned OFF after the last weld on Part 2.

Which of these welds will be saved as references?

None from Part 1. Although schedules 6-10 were executed after the Ref mode was turned ON, the welds were **overwritten** by the same schedule # welds made on part #2.

For schedules 1 to 5, only the Part 2 welds were captured and saved as reference welds.

It is important to remember that, if Ref mode is kept ON, it will automatically overwrite the reference record when the same schedule is called (fired) again.

☞ REFERENCE MUST BE TURNED OFF FOR THE REFERENCE WELD DATA TO BE STORED INTO MEMORY OF THE WELD TIMER AS A REFERENCE WELD. LOADING REFERENCES TO THE WELD TIMER MAY TAKE SEVERAL SECONDS AND WILL DISABLE THE TIMER MOMENTARILY.

IF REFERENCE IS TURNED ON AND MORE THAN 10 WELDS ARE MADE, THE WELD CONTROL WILL SET AN ALERT TO INDICATE THAT REFERENCE HAS BEEN LEFT ON. THIS ALERT IS INDICATED AS "**REFERENCE MODE ON".**

VERIFY ALL WELDS MADE WHILE REFERENCE IS TURNED ON, SATISFY THE REQUIREMENTS BELOW:

- View all of the weld graphs in the History/Graphs/Spot screen and verify that all welds made in Constant Current mode were expulsion free.

- Ensure that all the welds made in Constant Current mode have R Drop for the metal being welded (15-30% for galvanized and 30-50% for bare metals).

  ▷ **In case of expulsion** – Decrease the weld current and make another weld with the programmed weld schedule.

  ▷ **In case the R Drop is low** – Increase the weld current and make another weld with the programmed weld schedule.

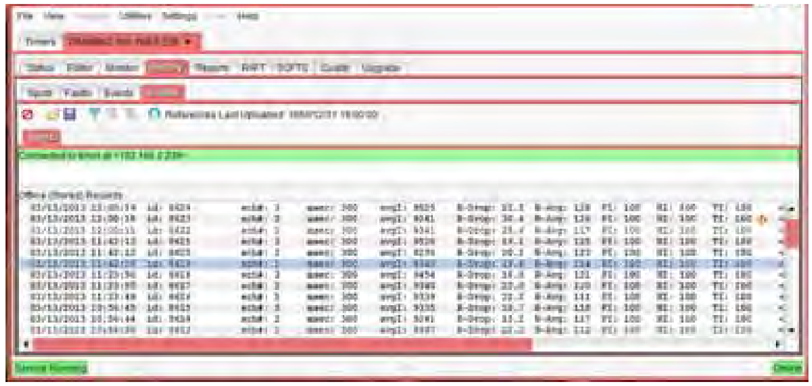
  ▷ **In case R Drop is high** – Decrease the weld current and make another weld with the programmed weld schedule.

Verify that all the welds made produced a minimum weld nugget set-up size by destructing the part and measuring all weld nuggets.

2. CREATING A SINGLE REFERENCE WELD FROM PAST WELD DATA

The History/Graphs/Spot tab displays many logged welds. Open the spot data for the weld that you want to reference.

Double click on the weld to view the weld graph



Check all welds that were made satisfy the requirements below:

- Had NO expulsion.

Had the proper R Drop for the metal being welded (15-30% for galvanized and 30-50% for bare metals).

▷ In case of expulsion – Decrease the weld current and make another weld with the programmed weld schedule.

▷ In case the R Drop is low – Increase the weld current and make another weld with the programmed weld schedule.

▷ In case R Drop is high – Decrease the weld current and make another weld with the programmed weld schedule.

EXAMPLES OF REFERENCE WELDS:

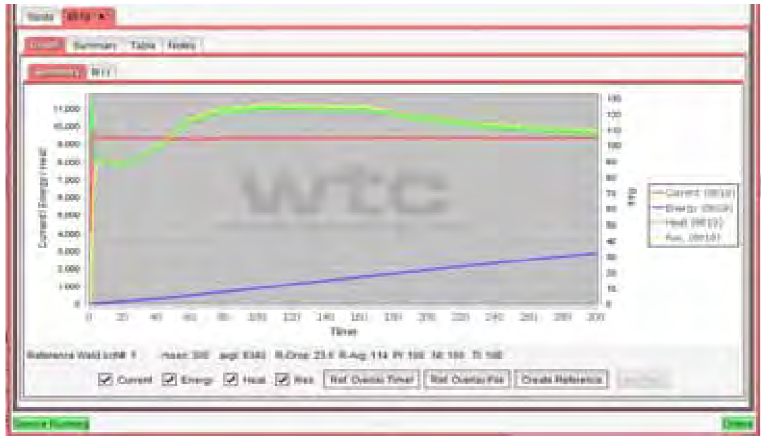


Figure 10.4 Good Constant Current Weld

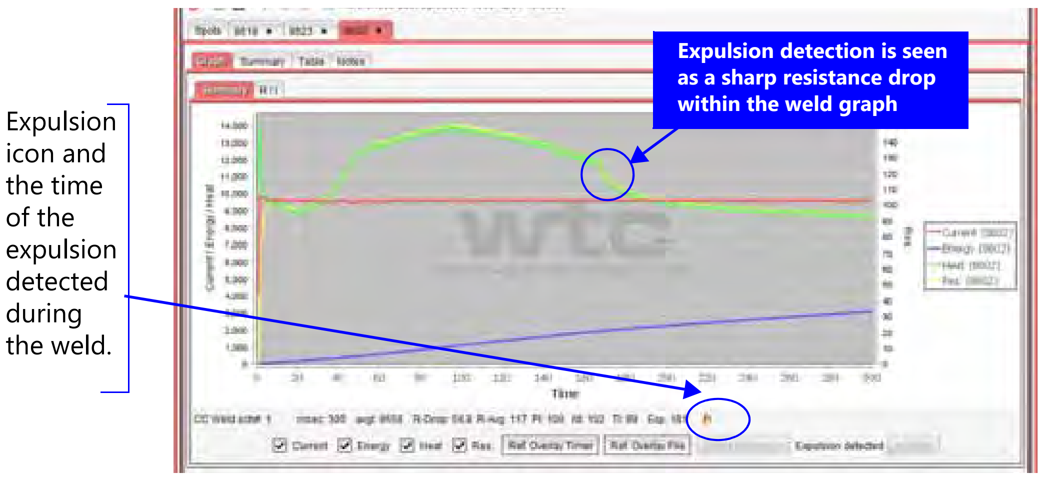


Figure 10.5 Bad Constant Current weld with Expulsion

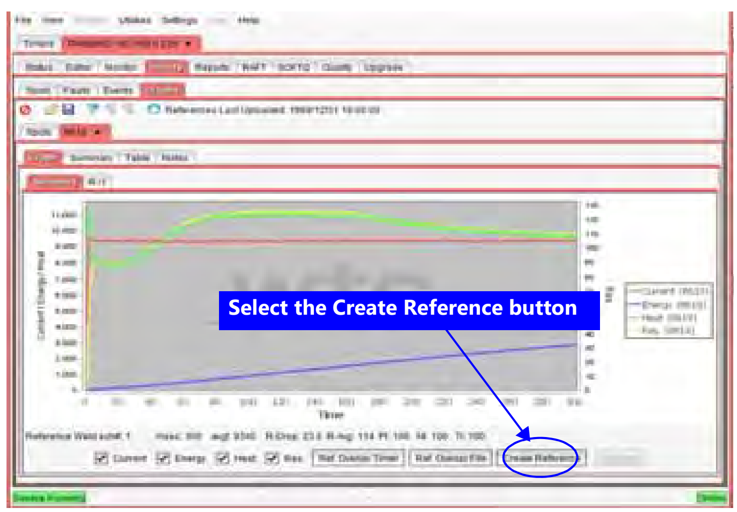
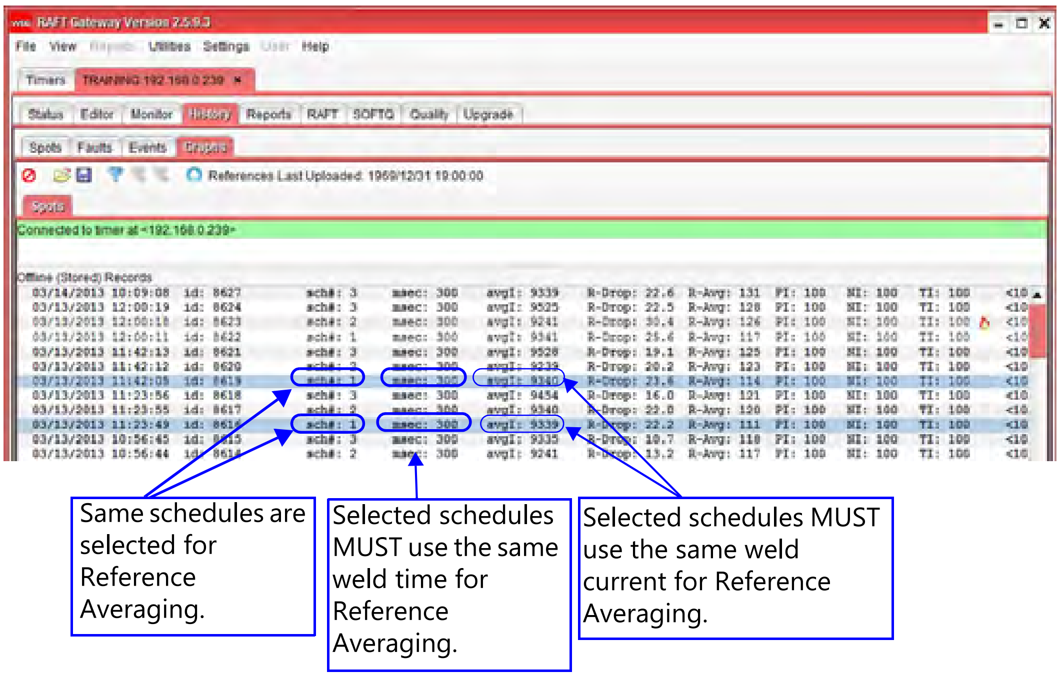


Figure 10.6 Create a Reference

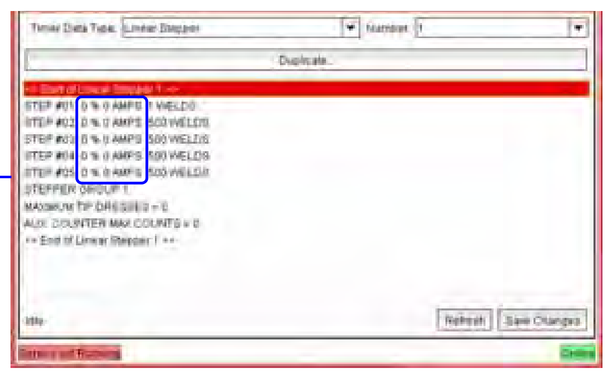
If the weld spot had NO expulsion, proper Rdrop was made throughout the weld and the nugget set-up size measurement meets the minimum set-up size requirement, click to select the "Create Reference" button while viewing the weld graph.

3. AVERAGING A REFERENCE WELD

Select multiple welds of the same schedule with the same time and current programmed from the History/Graphs/Spot screen.



It is a good practice to set all steps to 0% boost.
NOTE: The stepper boost changes the current in every weld made with the same schedule. ***RAFT***™ Gateway does not average welds made with different current values.



Verify all welds selected for averaging to create a Reference weld:

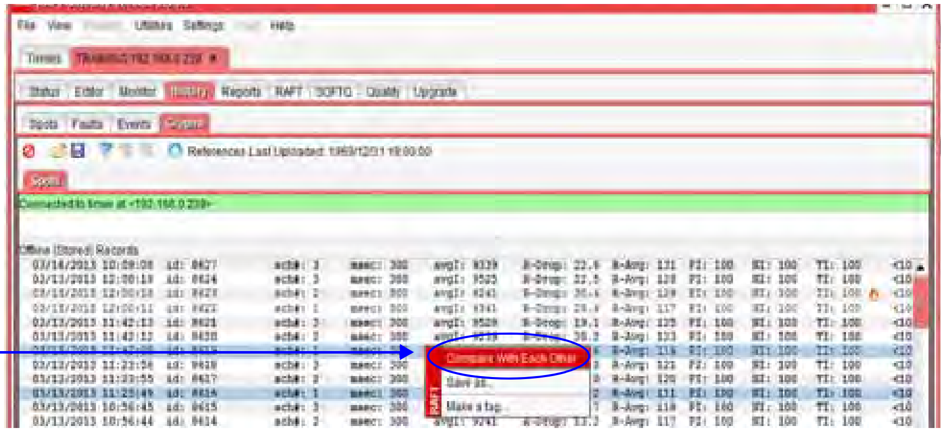
- Have the same schedule
- Used the same time and weld current that is currently programmed in the weld schedule.

- Were not made in adaptive mode.
- Had NO expulsion.
- Had the proper Rdrop for the metal being welded (**15-30%** for galvanized and **30-50%** for bare metals).

▷ **In case of expulsion** – Decrease the weld current and make another weld with the programmed weld schedule.

▷ **In case the R Drop is low** – Increase the weld current and make another weld with the programmed weld schedule.

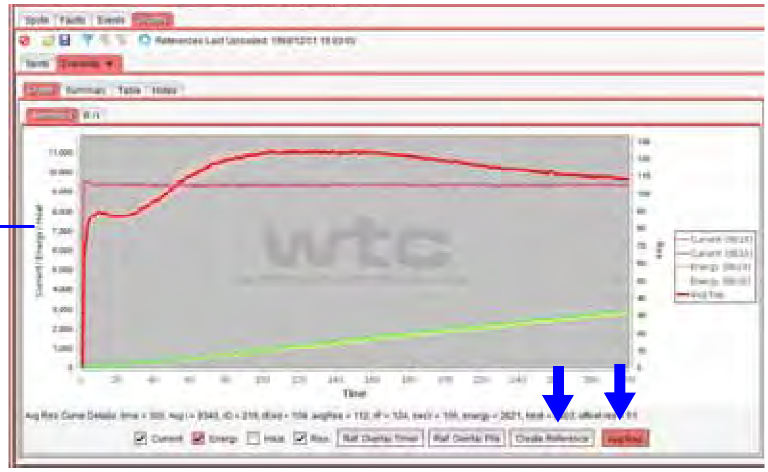
▷ **In case R Drop is high** – Decrease the weld current and make another weld with the programmed weld schedule.



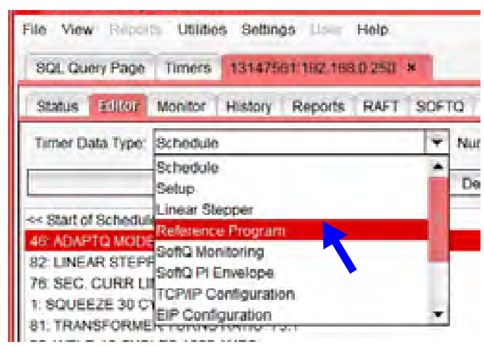
Highlight the selected weld spots. Right click and select "Compare with Each Other". All the welds selected will now be overlaid in one weld graph window.

NOTE: RAFT Gateway compares the graphs selected and will not create an average curve if data is not consistent. In this case, the lower part of the screen will display "Differences too big".
In many cases, the curves may seem similar to the user, but the software considers every millisecond of the graph.
Try another selection by replacing one or more of the graphs.

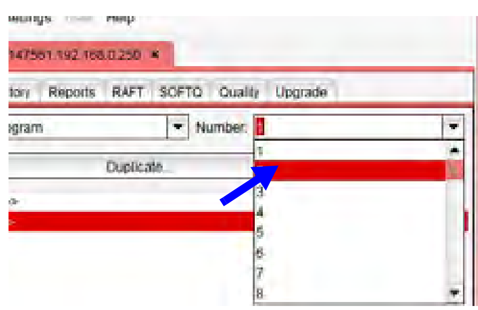
Single click on the "Avg. Res" button in the lower right corner of the weld graph window. Single click on the "Create Reference" button. The average resistance curve is now used for the Reference weld.



4. DUPLICATING A REFERENCE WELD

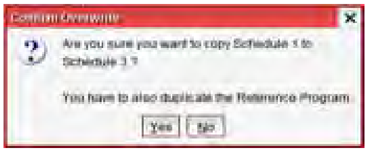


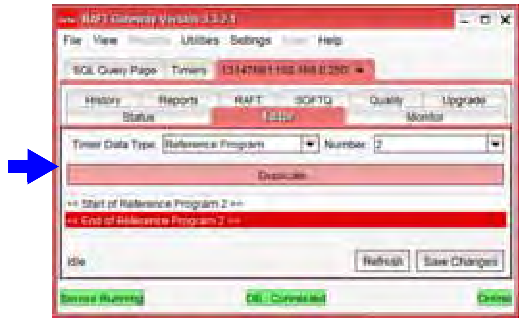
① In the timer Editor tab, select "Reference Program" from the Timer Data Type drop down menu.



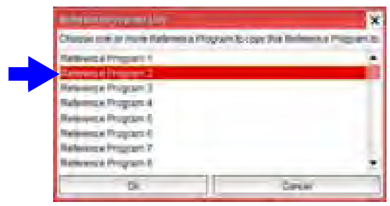
② Select the Reference Number to copy. (Weld spot made on the same metal stack-up with the same current, time and gun pressure)

NOTE: When duplicating reference programs, any schedules associated with these reference welds are not automatically copied and have to be duplicated as a separate function step. This function is annunciated with a reminder pop-up box when duplicating schedules.





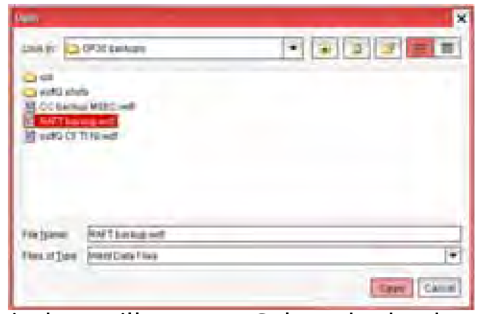
③ Single click on the “Duplicate” button.



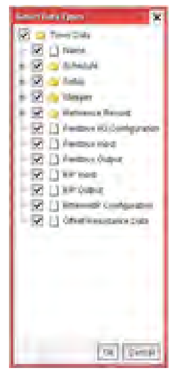
④ A drop down menu will be displayed. Select the Reference Program to copy to. Then, press “OK” to save the reference weld.

5. DOWNLOAD A REFERENCE WELD

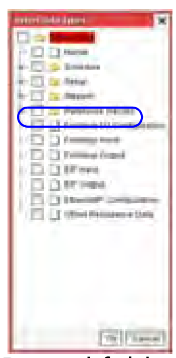
① In the timer Status Screen, select Download: File To Timer.



② A pop-up window will appear. Select the backup file. Then Click “Open”.

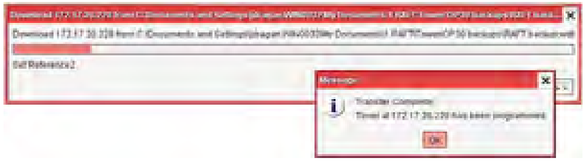


③ Uncheck all data types by clicking the Timer Data check box.



④ Expand the Reference Record folder by clicking the + icon.

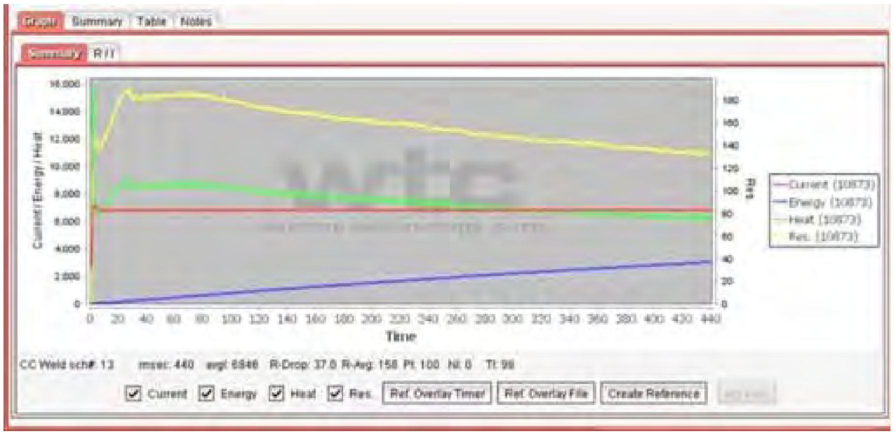
⑤ Select the desired reference record and click OK.



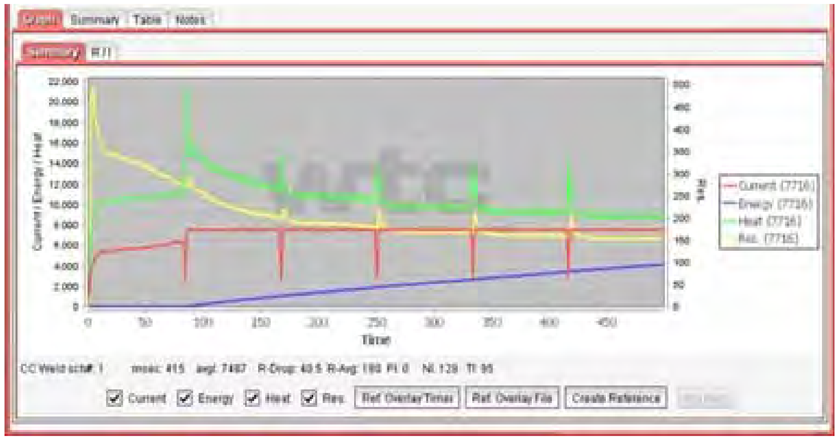
⑥ A pop-up window will display the download process followed by "Transfer Complete" message. Click OK to acknowledge.

EXAMPLES OF ACCEPTABLE REFERENCE RESISTANCE CURVE:

Figure 10.7 Plain Steel: 0.7mm to 0.7mm bare mild, R Drop = 45.8



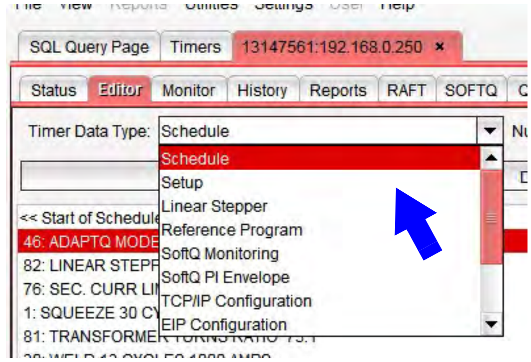
High Strength Steel: 1.25mm to 1.25mm DP780, R Drop = 37.0



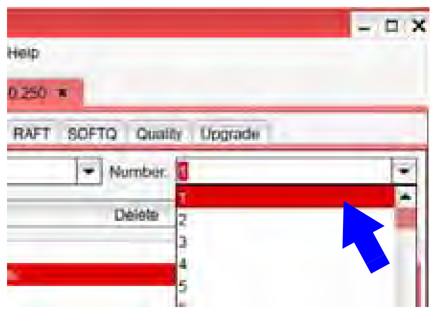
Preheat and Pulsing: 1.6mm to 1.6mm BORON, R Drop= 40.5

Preheat: 0.7mm HDG / 1.5mm HDG / 1.5mm HDG (all MILD), R Drop = 22.8

BEGIN *RAFT* ADAPTIVE WELDING



① Start by selecting the weld schedule to edit. Click on the Editor tab which will open a drop down menu. Select Schedule.



② Select the schedule number

Verify the AdaptQ™ function is inserted in each weld schedule intended for Adaptive. Default values are programmed.

"ADAPTQ MODE = 0 RATE =100% WSLIDE = 100%"

RATE and WSLIDE are initially set to 100%

③ Ensure the AdaptQ™ High & Low Current Limit Windows in the Setup Parameters are set to the appropriate percentage of the target current for the welding application.
For example, consider the default value of parameter:
ADAPTQ LOW CURR LIMIT WINDOW (%):
If the base current of a particular schedule is 10,000A, in cases where a batch of parts are made from a metal with higher R (thicker coating), AdaptQ is allowed to reduce the current to 8,000A. This current reduction may generate cold welds.

TUNING THE ADAPTIVE WELD SCHEDULE

Follow the procedure below to tune the RATE% and WSLIDE% parameters in the main adaptive function ADAPTQ MODE=1 RATE=100% WSLIDE=100%.

RATE: Range = (95-105); Default = 100

RATE modifies the current reaction levels (aggressiveness) of the Adaptive system.

When to adjust Rate%

Decrease RATE (below 100%):

- When the adaptive current increase causes expulsion in the first half of the weld time.
- Reduce the RATE by 1%, maximum 2% at a time and observe the effect of the change.
- If RATE = 95 and no improvement is detected, the Reference weld for that spot is “too hot” and must be re-done using a lower current value.

Increase RATE (above 100%):

- When the weld has NO expulsion and weld time is extended by more than 10% of the Reference Weld time.
- Increase RATE by 1%, maximum 2% at a time and observe the effect of the change.
- If RATE = 105 and no improvement is noticed, the Reference weld for that spot is “too cold” and must be re-done using a higher current value.

WSLIDE: Range = (95-105); Default = 100
WSLIDE adjusts the adaptive weld time by modifying the Reference Resistance Drop and the Reference Total Energy targets.

When to adjust WSLIDE%:

DECREASE (below 100%)
When ALL the following conditions are true:
▷ Tear down inspection shows oversized nuggets
▷ Welds have no expulsion during the reference weld time
▷ Weld time is extended by more than 10% of the reference weld time

- Decreasing WSlide% will reduce time extension by lowering target Resistance drop and target energy.
- It will also reduce the nugget size, which is why the change MUST be validated by tear down inspection.

INCREASE (above 100%)
▷ When tear down report shows nugget size approaching minimum size.

- Increasing WSlide will increase the adaptive nugget size by raising the target for Resistance drop and Energy.
- Increasing WSlide will also extend the weld time.

SOFTQ OVERVIEW

SOFTQ is a ***RAFT™*** feature that alerts the weld engineer/ maintenance staff when the weld process has changed. Examples of process change include missing part, extra part, changes in water cooling, tip dress cutter failure, tooling wear, etc.

SOFTQ uses a defined benchmark of the welding system to analyze the weld process.

WHAT IS THE SOFTQ BENCHMARK?

The benchmark is a known good set of production welds. The weld engineer selects this data set from the data collected by ***RAFT™*** Gateway.
This group of welds should include:

- All the "normal" disturbances, i.e. cap wear, part placement and fit-up variations.
- It must contain at least (2) tip dress cycles of welds for a particular robot/ weld control.
- From this data set, the Fault and Trend monitoring limits can be created either manually or through an automated feature of ***RAFT™*** Gateway called the Easy Button.

NOTE: SOFTQ FUNCTIONS WITH BOTH CONSTANT CURRENT AND ADAPTIVE WELDING MODES.

PROCESS INTEGRITY (PI)

Process Integrity (P-Integrity) is a percentage value provided post weld, which represents the quality of the last weld as compared to the Reference Weld. Process Integrity also identifies weld nuggets, which may be undersized based on a lower percentage.

Process Integrity values benefit the user because normal Constant Current values cannot indicate if the weld control created enough heat to form a good weld nugget. Constant Current welding only identifies the output of the weld control. Process Integrity values allow the user to identify a relationship between last weld and the ideal weld nugget created during the Reference Weld.

The ***AdaptQ*** module examines the characteristics of the Reference Weld and compares that to the weld in progress. As variations in characteristics are detected, the ***AdaptQ*** module compensates by adjusting the current, energy and time of the weld in progress. Once the weld is completed, the SoftQ module analyzes the performance of the ***AdaptQ*** module and calculates a Process Integrity.

The PI value is a percentage of the weld, which is within the process envelope as setup in the ***RAFT™*** Gateway software.

The range of PI values are between 0% and 100%:

- A lower percentage represents a cooler weld nugget.
- A higher percentage represents a hotter weld nugget.

The SoftQ module allows users to set limits for acceptable Process Integrity values, as defined in SoftQ monitoring and trending within the ***RAFT™*** Gateway software.

TOOLING INTEGRITY (TI)

Tooling Integrity (T-Integrity) is a percentage value provided post weld, which represents the electrical effort required to make the last weld as compared to the status of the weld tooling when the Reference Weld was made. As more welds are made, the resistance characteristics of the weld tooling changes. The Tooling Integrity percentage shifts as the weld tooling becomes more or less resistive as compared to what the tooling characteristics were when the Reference Weld was made.

The range of TI values are between 1% and 150%, where 100% represents the tooling integrity of the reference weld.

- A lower percentage represents increased resistance of the weld tooling.
- A higher percentage represents current shunting in the weld tooling.

The SoftQ module allows users to set limits for acceptable Tooling Integrity values, as defined in SoftQ monitoring and trending within the ***RAFT™*** Gateway software.

NUGGET INTEGRITY (NI)

Nugget Integrity (N-Integrity) is a percentage value provided post weld, which represents a ***confidence*** level that the weld produced an acceptable nugget.

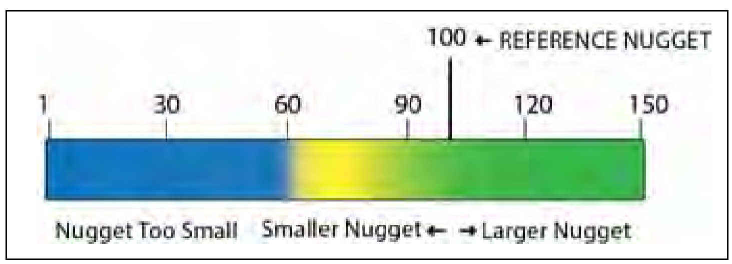


Figure 10.8 Nugget Integrity (NI) Scale

NI is the result of a complex calculation that uses Resistance values (R Drop, R Peak, R Graph), Heat, Energy, Weld Current and Time of both the Reference and the last weld.

Due to the multitude of process variables involved, ***NI cannot be used as an absolute nugget size indicator.***
Example: *The following assumption is FALSE -*
If reference weld nugget diameter avg. was 6.0 mm, then a weld with NI=120 will generate a 6.0 x 1.2 = 7.2 mm avg. diameter nugget.

In the tip life cycle of a stable welding process, typical NI values are from 80% to 120%.

FORCEQ OVERVIEW

ForceQ™ is a post weld analyzer that uses the force feedback signal to alert the weld engineer/maintenance staff when the weld process has changed. Examples include missing part, extra part, bad weld position, edge weld, etc.

ForceQ™ uses a defined benchmark of the welding system to analyze the weld process, predict weld quality and monitor the weld gun force.

FORCEQ BENCHMARK

The *ForceQ*™ benchmark is created by the weld engineer from known good production weld data.

This group of welds should include all the normal disturbances, i.e. cap contamination, part placement and fit-up variations.

When the benchmark is created, it includes parameters such as Pre-minimum Force, Force Integrity (FI) and Force Nugget Integrity (FNI).

The automated process of creating the benchmark puts intelligent limits on all of these parameters. These limits can also be manually adjusted for specific conditions

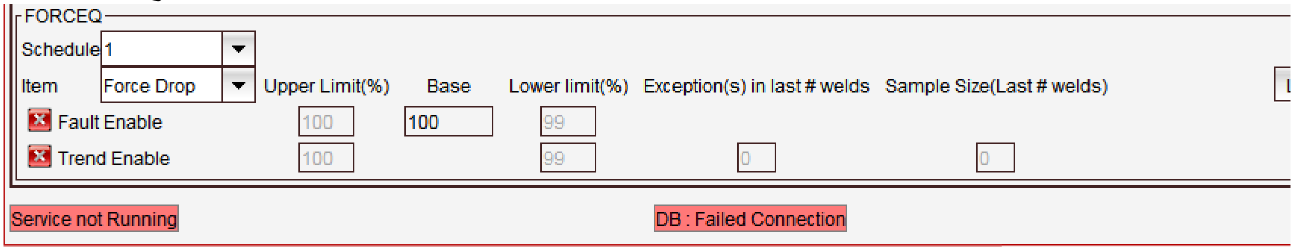
.

NOTE:

FORCEQ™ FUNCTIONS WITH BOTH CONSTANT CURRENT AND ADAPTIVE WELDING MODES. FOR FORCEQ™ TO WORK, REFERENCE WELDS MUST BE TAKEN FOR EACH SCHEDULE.

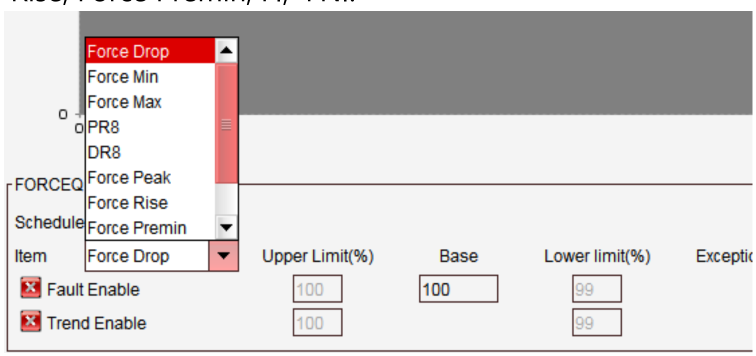
ForceQ monitoring functions under ForceQ page monitors different parameters by setting up high/low limit windows. The user will get an Alert/Fault when the data is outside the window.

FORCEQ MONITORING SETUP



- **SCHEDULE**
  Select a schedule to monitor.

- **ITEM**
  Select an item to monitor from the drop down list- Force Drop, Force Min, Force Max, PR8, DR8, Force Peak, Force Rise, Force Premin, FI, FNI.



- **FAULT ENABLED/DISABLED**
  Enable or Disable Fault limits – Checked box is Enabled – Unchecked box is Disabled.

  The weld control's response to the alarm must be defined in the Setup parameters under the EDITOR tab. (Severity = Fault or Alert)

- **TREND ENABLED/DISABLED**
  Enable or Disable Trend limits – Checked box is Enabled – Unchecked box is Disabled.

  The weld control's response to the alarm must be defined in the Setup parameters under the EDITOR tab. (Severity = Fault or Alert)

- **FAULT LIMITS**
  Define Upper (100-200%) / Lower (99-0%) alarm limit values.

- **TREND LIMITS**
  Define Upper (100-200%) / Lower (99-0%) alarm limit values.

- **SAMPLE SIZE (LAST # WELDS) (0-64)**
  Number of previous welds to take into consideration (Lot must be greater than or equal to "Exception(s) in last # of welds" size.

- **EXCEPTION(S) IN LAST # WELDS (0-64)**
  Amount of welds above the Upper Trend limit or below the Lower Trend limit (must be less than or equal to the "Sample Size (Last #of welds)" size.

- **BASE**
  Base programmed value of the "Item" monitored for Alarm Enabling. (0-99990)

- **SAVE TO TIMER**
  Saves all programmed values to the weld timer. Button will be yellow if there have been changes made.

- **LOAD FROM TIMER**
  Load all data from the timer.

- **DUPLICATE**
  Ability to copy the *ForceQ* Monitoring data from one schedule to another.

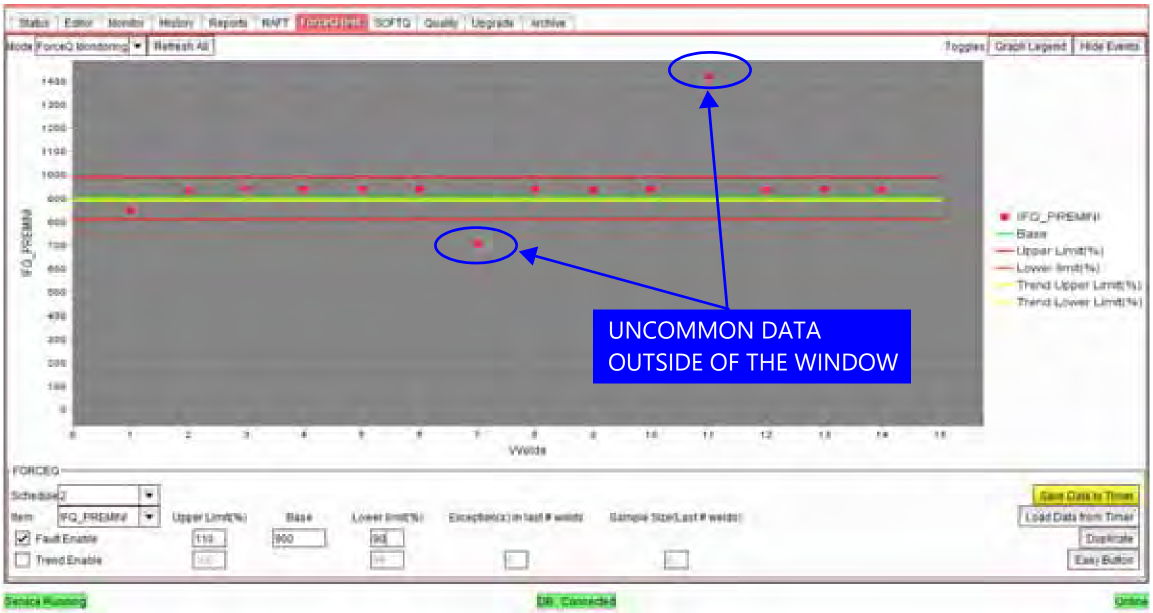


Figure 10.9 Example of Force Graph

NOTE:

FORCE DATA WILL IS ONLY REPORTED WITH ACTIVE LICENSE. ALL ZEROS ARE DISPLAYED WITH INACTIVE LICENSE.

FORCEQ INTEGRITY

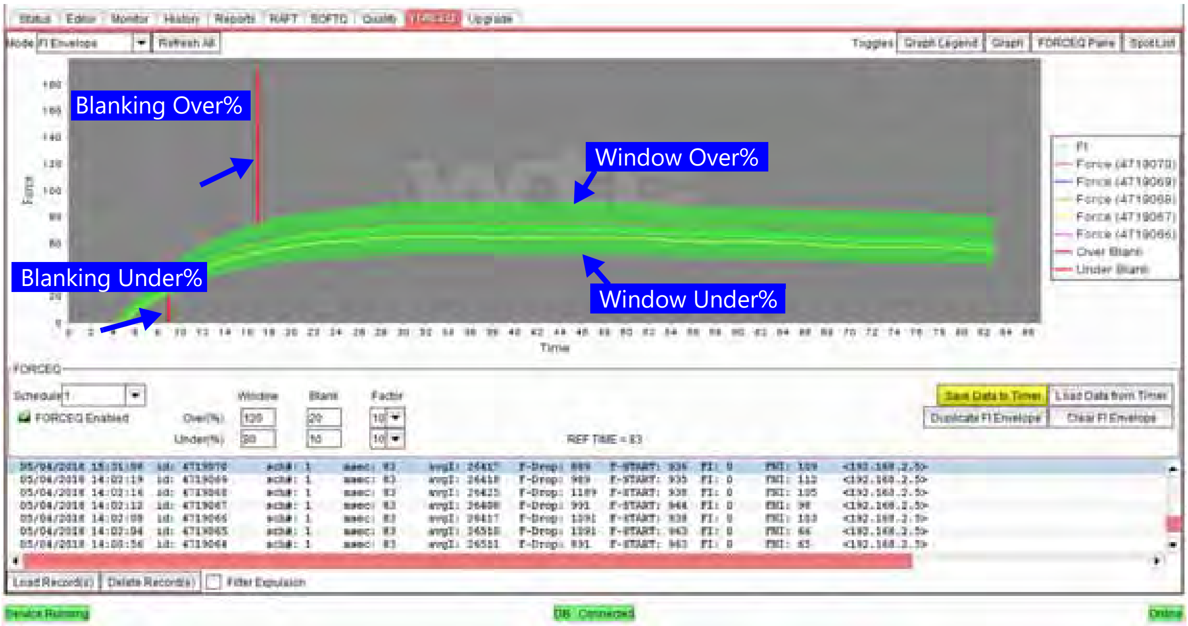
ForceQ Integrity (FI) is a percentage value based on the force curve that describes the weld process in relation to the benchmark.

The group of welds selected to create the benchmark generates an envelope of the force graph. This is the FI envelope.

Figure 10.10 Example of a FI Envelope

FI ENVELOPE SETUP PARAMETERS:

- ***WINDOW OVER %*** **:**
  The upper limit of the FI envelope, defined as XXX% of the highest force value at any point in time.
- ***WINDOW UNDER %*** **:**
  The lower limit of the FI envelope, defined as XX% of the lowest force value at any point in time.
- ***BLANK OVER %*** **:**
  The percentage of total weld time that is excluded from the upper portion of the FI envelope at the beginning of the weld.
- ***BLANK UNDER %*** **:**
  The percentage of total weld time that is excluded from the lower portion of the FI envelope at the beginning of the weld.
- ***FACTOR %*** **:**
  A threshold amount of weld data points, defined as a percentage of the total weld time (excluding blanked time). Used to determine FI value.
- ***FORCEQ ENABLE*****:**
  Timer will calculate FI after this button is clicked.



FORCEQ NUGGET INTEGRITY

ForceQ Nugget Integrity (FNI) is a percentage value provided post weld, which represents a ***confidence*** level that the weld produced an acceptable nugget.

The user must create a reference before starting to use ForceQ. A reference weld is the stored Constant Current weld data that *ForceQ* uses to compare subsequent welds.

CRITERIA FOR A SUCCESSFUL REFERENCE WELD:

- A proper reference weld must be free of weld disturbances (expulsion, gaps, misaligned or worn tips, edge welds, gun to metal misalignment, etc.).
- Smooth Force curve shapes, instead of sharp inclines or declines give the best results (See examples).
- The reference weld nugget diameter should meet (or exceed) the target value.
- To optimize *ForceQ*, each spot must be assigned to a unique weld schedule.

Figure 10.11 Example of a smooth Force curve indicating no expulsion was detected

HOW TO CREATE FORCE REFERENCE:

① Season the cap: Make 6-10 welds after tip dressing to season the cap. All of these welds must be under same schedule number and same welding process

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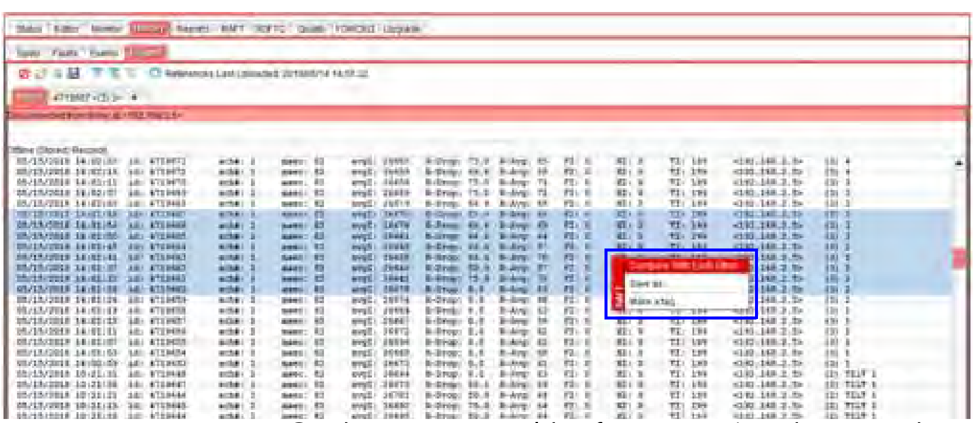
A FORCEQ REFERENCE WELD IS CREATED AFTER SEASONING THE CAPS WITH A MINIMUM OF 6-10 WELDS, BUT NO MORE THAN 30 WELDS.



② Choose 6-10 welds after seasoning the caps, then compare with each other. All of these welds must be under same schedule and same welding process.

③ After you open the graphs page click “Avg Force” button to average the force curve shown as the green line.

After averaging the force graph click the “Create Reference” button to create reference for this schedule.

RAFT™ MENU (DEP-300S)

The ***RAFT™*** Menu allows the user to view ***RAFT™*** data and perform certain ***RAFT™*** functions. This feature is customer application specific and may be inaccessible. For more information, see the DEP-300s manual PN: M-035030.

To access the ***RAFT™*** functions on the DEP-300s:

① Press 

Status Mode.

Press 

RAFT.

NOTE:

THE DATA DISPLAYED IN THIS MENU MAY VARY DEPENDING UPON THE CUSTOMER'S APPLICATION REQUIREMENTS. FOR APPLICATION SPECIFIC INFORMATION, CONSULT THE WELD TIMER FIRMWARE MANUAL.

THE FOLLOWING OPTIONS ARE AVAILABLE WITHIN THE *RAFT™* MENU BY PRESSING THE CORRESPONDING KEYS, [F1] THROUGH [F5]:

	This key returns the user back to the previous Status Menu screen.
	This key allows the user to copy the ***RAFT™*** Reference Weld data from one schedule to another.
	This key allows the user to turn the R Measure Mode ON or OFF.
	This key allows the user to turn the Reference Mode ON or OFF.

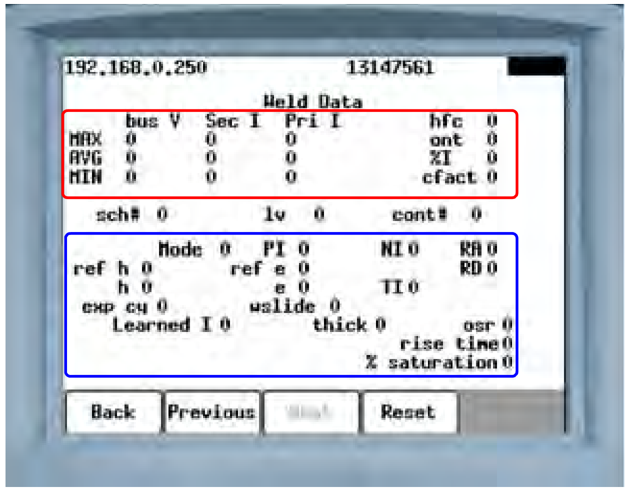
THE FOLLOWING DESCRIBES THE DATA TAGS DISPLAYED IN THE *RAFT™* STATUS MENU:

NOTE: THE DATA DISPLAYED IN THIS MENU MAY VARY DEPENDING UPON THE CUSTOMERS' APPLICATION REQUIREMENTS. FOR APPLICATION SPECIFIC INFORMATION, CONSULT THE WELD TIMER FIRMWARE MANUAL.

DATA TAG	DESCRIPTION
SEQ#	Sequence (schedule) number
MODE	AdaptQ Mode ON/OFF (0=OFF, 1=ON)
REF H	Total heat of the Reference Weld
H	Total heat
EXP CY	The number of milliseconds since the beginning of the weld at which expulsion was detected
PI	Process Integrity
REF E	Total energy of the Reference Weld
E	Total energy
NI	Nugget Integrity
TF	Tool Factor: The C-Factor of the last 3/4 of the weld time, minus the blanking period
TI	Tooling Integrity
RA	Average Resistance
RD	Resistance Drop
RE	End Resistance

WELD DATA MENU (DEP-300S)

The Weld Data Menu allows the user to view various Weld and ***RAFT™*** data values, which occurred during the last weld.



In the above example of the DEP-300s Weld Data Menu, the data circled in blue is Constant Current and Percent of Available Volt-Seconds weld data. The data circled in red is ***RAFT™*** weld data.

THE FOLLOWING DESCRIBES THE DATA TAGS DISPLAYED IN THE DEP MENU:

WELD DATA

DATA TAG	DESCRIPTION
BUS V	DC bus voltage (MAX, AVG, MIN)
SEC I	Secondary current (MAX, AVG, MIN)
PRI I	Primary current (MAX, AVG, MIN)
HFC	High frequency cycles (inverter output)
ONT	On-time of the inverter in microseconds
%I	Percent of available volt-seconds measurement
CFACTOR	C-Factor calculation
SCH#	Schedule number
LV	Inverter DC bus voltage (updated frequently)
CONT#	Contactor number

***RAFT*™ DATA**

DATA TAG	DESCRIPTION
MODE	AdaptQ Mode ON/OFF (0=OFF, 1=ON)
REF H	Total heat of the Reference Weld
H	Total heat
EXP CY	The number of cycles since the beginning of the weld at which expulsion was detected
LEARNED I	The running adaptive current, as learned by the adaptive algorithm, from the last weld
PI	Process Integrity
REF E	Total energy of the Reference Weld
E	Total energy
WSLIDE	Programmed WSLIDE from the AdaptQ function
THICK	The estimated stack-up thickness based on the resistance reading during the weld.
NI	Nugget Integrity
TI	Tooling Integrity
RA	The average resistance of the last 166 mid-frequency cycles
RD	The resistance drop since the peak resistance (RP)
OSR	Offset resistance as calculated for the stepper group
RISE TIME	Number of MFDC half cycles to reach current
% SATURATION	Percent of MFDC half cycles terminated by primary current

RAFT™ SCHEDULE FUNCTIONS

The following is a list of all the ***RAFT™*** AdaptQ and SoftQ functions that can be programmed in the weld schedule. To find the corresponding function number to a ***RAFT™*** function below, see "Chapter 4: Weld Functions" on page 29.

FUNCTION NAME	DESCRIPTION
PORTABLE GUN MODE	This function is inserted in the weld schedule when using the AdaptQ feature to weld various metal stack-up thicknesses with one schedule. This function should be inserted before the weld function.
GAP RULE RD=NN	This function sets the percent of resistance drop at which an **ADAPTQ GAP CONDITION FAULT** is set. This is used in applications where it is necessary to eliminate false gap detection. This function overrides the default percentage of resistance drop set in the software. Range 15-99%
DETAIL MODE	When inserted in a schedule (typically as the 1st or 2nd function) it changes the graph background from gray to black and replaces Energy/ Heat with Secondary Voltage/ Power. Graph in detail mode includes periods of cool time between weld/ heat pulses. **NOTE:** AFTER ONE WELD HAS BEEN DISPLAYED IN DETAIL MODE, BACKGROUND WILL REMAIN BLACK UNTIL THE TIMER TAB IS CLOSED AND RE-OPENED.
EDGE WELD	This function is added into the schedule when the operator knows that edge welding will occur, but still wants to accept the integrity of the nugget. An edge weld results in a number of milliseconds of heat falling under the heat of the reference weld. Adding this function into the schedule prevents the Nugget Integrity (NI) from changing (typically decreasing) when this occurs. This function should be inserted before the weld function.

FUNCTION NAME	DESCRIPTION
EXP NN% CONTROL NNN% HEAT NNN% ENERGY	**CONTROL:** The percentage of resistance drop that is used to identify an expulsion event. Range: 5-50% Default = 5% **HEAT:** The percentage of heat to be applied after an expulsion occurs, based on the reference heat. Range: 50-150% Default = 50% **ENERGY:** The percentage of energy to be applied after an expulsion occurs, based on the reference energy. Range: 50-150% Default = 50%
ADAPTQ MODE=NNNN RATE=NNN% WSLIDE=NNN%	**MODE:** This parameter turns the ***RAFT™*** AdaptQ module either ON or OFF for the weld schedule it is inserted into. Range: 0-1 1=Adaptive welding mode 0= Constant Current Mode **RATE:** Adjusts the current control levels of the adaptive weld. The default value is 100%. Range: 95-105% **WSLIDE:** Adjusts the Reference Resistance Drop and the Reference Total Energy target. The default value is 100%. Range: 95-105% **NOTE:** THIS FUNCTION MUST BE INSERTED IN THE WELD SCHEDULE PRIOR TO THE WELD FUNCTION AND IS TYPICALLY THE FIRST FUNCTION IN THE SCHEDULE.

FUNCTION NAME	DESCRIPTION
ADAPTQ IMX=NNNN0 IMN=NNNN0 TMX=NN MS	**IMX (Current Max):** Sets the maximum secondary current limit for the adaptive weld (in amps). Range:0-25,500 **IMN (Current Min):** Sets the minimum secondary current limit for the adaptive weld (in amps). Range: 0-25,500A **TMX (Time Max):** Sets the maximum limit the AdaptQ algorithm will extend the weld time (in milliseconds) to achieve the Reference Weld energy and produce a good weld. Range: 0-1000 MS Programming Example: ADAPTQ IMX=8000 IMN=7000 TMX=600 MS WELD 300 MS. 7500 AMPS This function is used to provide custom limits for the AdaptQ parameters that apply only to the schedule where this function is inserted. If any of these parameters are set to 0, the weld timer will use the corresponding Setup parameter (ex: IMN = 0, timer will use Setup parameter 10%). Conversely, if any parameter is set to a value > 0, that value will be used instead of the Setup value. Use caution when programming these custom limits. These limits will restrict the operation of the AdaptQ algorithm and can cause cold welds or expulsion. • IMX too low (Ex: +200A from weld function value) can cause cold welds! • IMN too high (Ex: -100A from weld function value) can cause expulsion! • TMX too short (Ex: +100msec from weld function value) can cause cold welds! Do not change the values unless you have the means to monitor production and validate your changes through tear-down! **NOTE:** WHEN THIS FUNCTION IS USED IN THE WELD SCHEDULE, THE TMX PARAMETER OVERRIDES THE "GLOBAL" ADAPTQ MAX TIME LIMIT SETUP PARAMETER. **NOTE:** THIS FUNCTION MUST BE INSERTED IN THE WELD SCHEDULE PRIOR TO THE WELD FUNCTION.

FUNCTION NAME	DESCRIPTION
TIP CHECK NNN MS/ IMP. NNNN0 A +/-NN UOHM	**TIME:** Weld time in Milliseconds (MS). Range: 0-9999 MS **CURRENT:** Weld current in Amps (A). Range: 0-99990 **WINDOW:** Resistance tolerance window n micro-ohms (uOHM). Range: 0-99 This is a specialized weld function, which is used after a tip dress. It checks the average resistance (RA) of the tip-to-tip weld against a limit window around the Master Offset Resistance. This function is typically inserted into a custom schedule, which must have the same stepper group assigned to it as the tool (gun) that is to be validated. If the average resistance (RA) measurement falls outside the tolerance window, a TIP RESISTANCE NOT IN WINDOW FAULT is generated. For example: Assuming the Master Offset Resistance is 60 micro-ohms and after the Tip Check weld was made, the tip-to-tip average resistance measured 50 micro-ohms. If the tolerance window was set to +/- 5 micro-ohms, then a TIP RESISTANCE NOT IN WINDOW FAULT would be generated. See “Tip dress verification (Tip Check) example using SoftQ Monitoring” on page 308. **NOTE:** THIS IS A PASS/ FAIL TYPE FUNCTION. IN CASE OF A FAULT, IT DOES NOT PROVIDE AN INDICATION OF HOW LOW/ HIGH THE RA WAS IN COMPARISON WITH THE LIMIT. A BETTER TOOL FOR THE TIP DRESS VERIFICATION IS TO USE A NORMAL WELD SCHEDULE AND SET SOFTQ RESISTANCE LIMITS AROUND THE MASTER OFFSET VALUE. **NOTE:** FOR INFORMATION REGARDING THE SETUP OF THE MASTER OFFSET RESISTANCE, SEE ADAPTQ WELDING STARTUP PROCEDURE ABOVE.

FUNCTION NAME	DESCRIPTION
EXP NNN % SPAN NN MS BLANKING NN MS	**EXP:** The expulsion detection rate in percentage. Range: 0 - 50% **SPAN:** The expulsion detection span in Milliseconds. Range: 0 - 16 MS **BLANKING:** Expulsion detection blanking period in Milliseconds. Range: 0 - 999 MS This function can be inserted in a weld schedule to modify the setup parameters for expulsion detection. This is used when one or a small number of weld schedules in a particular weld control have different expulsion conditions (material, current, force/pressure). The values programmed in the Setup Parameters are applied to all schedules and disregarded only in the specific schedule instance where this function is inserted. **NOTE:** ANY VALUE > 0 OVERRIDES THE SETUP PARAMETERS AND THE VALUE INSERTED IN THIS FUNCTION TAKES PRECEDENCE.
3T MODE	This function must be inserted before the weld function. It allows more or less current to be added to the weld, based on part resistance versus reference weld resistance. No current changes will occur until the end of the blanking time.
ROBOT MODE=NN	Range: 0-2 0= Disabled Inserted before main weld. **ROBOT MODE = 1**: Designed for very thin stack-ups 1.4 mm or below. **ROBOT MODE = 2:** Designed for materials with heavy coatings and higher tip contamination. After 100 welds, the starting current of the schedule is automatically increased and the adaptive current decrease is limited.
HIGH STRENGTH STEEL MODE	This function must be inserted before the weld function in the weld schedule when welding advanced high strength steels (tensile strength > 600MPa). Because high strength steels have a small current welding window, this function modifies the algorithm so that the current increases gradually.

RAFT™ SETUP PARAMETERS

DESCRIPTION	RANGE	DEFAULT
ADAPTQ MAX TIME EXTENSION (%) This parameter sets the limit for the adaptive weld time. When the weld time reaches the programmed value: • The adaptive weld is terminated • The ADAPTQ WELD AT TIME MAX LIMIT condition is generated (Fault/Alert/none). *Default value of 50% means that a 300msec weld will be extended to maximum 450msec.*	**0 to 200**	**50**
SOFTQ NON-ADAPTQ MODE FAULT This parameter gives the user the option to either enable or disable the SoftQ faults. DISABLED = SoftQ parameters DO NOT create Faults/ Alerts for schedules using Constant Current/ %I/ %VS mode. ENABLED = SoftQ parameters DO create Faults/ Alerts for schedules using Constant Current/ %I/ %VS mode. For adaptive welding (ADAPTQ=1), this parameter is ignored and the SoftQ faults are enabled.	**Disabled/ Enabled**	**Disabled**
WELD PROCESS STOP LIMIT This parameter provides the ability to track quality exceptions within a given part. When a given part exceeds the quality exceptions allowed a Fault is annunciated.	**0 to 99**	**0**
ADAPTQ High Curr Limit Window (%)	**0 to 99**	**20**
ADAPTQ Low Curr Limit Window (%)	**0 to 99**	**20**

RAFT™ FAULT DIAGNOSTICS

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
ADAPTQ TIP TO TIP WELD	FAULT/ALERT/ NONE DEFAULT: ALERT	Occurs when: 1. a tip-to-tip weld is made in adaptive mode (AdaptQ Mode=1). 2. The AdaptQ algorithm measured an average resistance value (RA) within 20 micro-ohms of the R Measure (Master Offset) resistance.	1. Verify welding on the correct metal stack-up and not tip to tip. 2. Verify Offset Resistance is correct. If not, a new R Measure may need to be done.
ADAPTQ TIP VOLT WIRE BROKEN	FAULT/ALERT/ NONE DEFAULT: FAULT	Occurs when the voltage sense wires that run between the gun tips and the weld timer are either broken, loose or disconnected. Alert/ None levels are only available for Constant Current welding. For an adaptive mode weld, the Fault level will be generated even when this parameter is set as Alert/ None.	Swap wires at the input of the weld timer to check for a polarity problem.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
ADAPTQ WELD AT TIME MAX LIMIT	FAULT/ALERT/ NONE DEFAULT: FAULT	1. Occurs when function #47 (ADAPTQ IMX=nnnn0 IMN=nnnn0 TMX=nnn-nMS) Is used in the weld schedule and the AdaptQ algorithm extended the weld time to the maximum limit (TMX) that was programmed. 2. Occurs when the AdaptQ algorithm extended the weld time to the maximum limit that is programmed into the ADAPTQ MAX TIME LIMIT/ EXTENSION in the Setup Parameters.	Determine what has changed in the welding process from when the reference weld was made and return it back to the conditions at the time of the Reference Weld. Compare the last weld graph to the reference weld: ▶ The last weld current should always start at the reference weld current value; if the starting value is visibly lower, ensure the programmed current matches the current of the reference weld. ▶ If there is a significant deviation in the Resistance curve, answer the following questions to find the cause of the process change: • Was the weld spot moved from the original setup position? • Was the position of the voltage sense wires changed as a result of maintenance work? If so, the R Measure needs to be redone since the resistance of the tool might have changed. • Is the metal stack-up correct? • Is the gun pressure correct? • Is the turn ratio setting correct? • Are the weld caps worn? • Are the tips properly dressed? Inspect gun condition, ensure voltage sense wires connections are not loose. • Inspect cooling tubes for weld tips. • If the cause of the change in conditions cannot be found, take a new Reference weld for that spot.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
ADAPTQ GAP CONDITION	FAULT/ALERT / NONE DEFAULT: FAULT	Occurs at the beginning of an Adaptive Weld and the AdaptQ algorithm detects a resistance at the weld interface greater than 350 micro-ohms.	Verify metal fit-up is correct. If a gap is present and can not be corrected, then add a pre-heat function in the weld schedule before the adaptive weld function.
ADAPTQ NO REFERENCE WELD	Non-Programmable DEFAULT: FAULT	Occurs if a Reference Weld was not performed prior to executing an Adaptive Weld.	Perform a Reference Weld for the appropriate metal stack-up.
ADAPTQ R MEASURE	Non-Programmable DEFAULT: FAULT	Occurs if the AdaptQ algorithm detects an R Measure (offset) resistance check had never been made for the assigned stepper group (gun). This fault can occur in either Reference or Adaptive mode.	Perform an R Measure for the appropriate weld gun, or assign the correct stepper/ group.
TIP RESISTANCE NOT IN WINDOW	FAULT/ALERT DEFAULT: FAULT	Occurs when: 1. function #43 (TIP CHECK nn CY. nnnn0 A +/-nn uOHM) is used in the weld schedule and the average resistance (Ra) measurement of the last tip-to-tip weld falls outside the parameter programmed in the tolerance window (+/-nn).	1. Verify the window around the Master Offset is correct. 2. Verify the tip dresser is functioning properly and dressing the caps correctly. • Is the tip dresser cleaning the tips properly? • Is the dresser blade spinning properly? • Is the correct pressure being applied to the dresser blades? • Is the weld gun tip alignment correct to the dresser blades? • Are the dresser blades worn? • Are the correct caps being used? 3. If all the above is correct, then most likely the R Measure is bad and needs to be re-done.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
REFERENCE MODE ON	FAULT/ALERT / NONE DEFAULT: ALERT	Occurs after 10 consecutive welds are made while Reference Mode is turned on. This alert is set as a reminder to the operator that Reference Mode is still on.	Turn Reference Mode OFF in the ***RAFT™*** Gateway software.
***SOFT Q* CURRENT**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for current, and the average secondary current exceeds the *SOFTQ* hard limit window (either high or low).	1. In Adaptive Mode, verify the SOFTQ current hard limit window is set correctly for the High and Low Current Limit Windows in the Setup Parameters or the ADAPTQ IMX IMN Function in the weld schedule. 2. In Constant Current Mode, verify the SOFTQ current hard limit window is set correctly for the linear current stepper assigned to the weld schedule. 3. If the SOFTQ Current Fault occurs in conjunction with a Current Regulation or Low Current Limit Fault, then follow the troubleshooting procedure for the respective fault in the manual.
***SOFTQ* RESISTANCE**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for resistance, and the average resistance exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ resistance hard limit window is set correctly for the weld schedule's total workpiece resistance. 2. Verify nothing changed in the weld tooling: • Check for proper tip dress. • Confirm the RMeasure value. If no workpiece is in the gun during Adaptive Mode, the SOFTQ Resistance Fault will occur in conjunction with an ADAPTQ Tip to Tip Weld Fault.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
***SOFTQ* SEC V**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for secondary voltage, and the average secondary voltage exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ secondary voltage hard limit window is set correctly for the weld schedule's total workpiece resistance. 2. Verify nothing changed in the weld tooling: • Check for proper tip dress. • Confirm the RMeasure value. If no workpiece is in the gun during Adaptive Mode, the SOFTQ Sec V Fault will occur in conjunction with an ADAPTQ Tip to Tip Weld Fault.
***SOFTQ* ENERGY**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for energy, and the average energy exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ energy hard limit window is set correctly to include all the data in one tip dress or cap life (as applicable). 2. Verify the workpiece is in the gun. If no workpiece is in the gun, the SOFTQ ENERGY fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT. 3. In Adaptive Mode- verify the weld time is not being extended due to excessive wear on the weld caps: • Open the setup windows. • Decrease RATE and WSLIDE where applicable.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFT Q **HEAT**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for heat, and the average heat exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ heat hard limit window is set correctly to include all the data in one tip dress or cap life (as applicable). 2. Verify the workpiece is in the gun. If no workpiece is in the gun, the SOFTQ Heat Fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT. 3. In Adaptive Mode, verify the weld time is not being extended due to excessive wear on the weld caps: • Open up the windows. • Decrease RATE and WSLIDE where applicable.
SOFTQ **C FACTOR**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for c-factor, and the average c-factor exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ C-factor hard limit window is set correctly for the data set. 2. Verify there is no slag build-up on the gun, shorts between transformer connections or defective diodes in the trans-former secondary since these may lead to a High C-factor. 3. Look for any resistance changes in the secondary of the weld tooling. Loose, frayed or incor-rect length shunts; loose trans-former connections; worn transformer cables; bad or incor-rect weld caps are all causes for Low C-factor.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ **T-INTEGRITY**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for T-Integrity, and the average T-Integrity exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ T-Integrity hard limit window is set correctly for the data set. 2. Verify there is no slag build-up on the gun, shorts between transformer connections or defective diodes in the trans-former secondary since these may lead to a High TI. 3. Look for any resistance changes in the secondary of the weld tooling. Loose, frayed or incor-rect length shunts; loose trans-former connections; worn transformer cables; bad or incor-rect weld caps are all causes for Low TI. 4. Check for proper tip dress. 5. Confirm the RMeasure value.
SOFTQ **WELD TIME**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for weld time, and the average weld time exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ weld time hard limit window is set correctly under normal conditions. 2. In Adaptive Mode, verify the RATE or WSLIDE parameters are not set incorrectly. 3. Verify there are no changes in the welding process or any part disturbances that would cause weld time to be extended. 4. The only way a SOFTQ Weld Time Fault can occur in Constant Current Mode is if the weld time is changed and is longer than it was when the SOFTQ weld time hard limit window was set.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
***SOFTQ* P-INTEGRITY**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for P-Integrity, and the average P-Integrity exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ P-Integrity hard limit window is set correctly under normal conditions. 2. Verify the process envelope is set up correctly in the ***RAFT™*** Gateway software. 3. If a problem still exists, then it is caused by a workpiece distur-bance: • Tooling disturbance. • Part disturbance, i.e. excessive gap, stack-up change, poor tip dressing, etc.
***SOFTQ* N-INTEGRITY**	FAULT/ALERT DEFAULT: FAULT	Occurs when the *SOFTQ* level is setup and enabled for N-Integrity, and the average N-Integrity exceeds the *SOFTQ* hard limit window (either high or low).	1. Verify the SOFTQ N-Integrity hard limit window is set correctly under normal conditions. 2. Verify a part disturbance doesn't exist, i.e. excessive gap, stack-up change, poor tip dressing, etc.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ **CURRENT TREND**	FAULT/ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for current, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size. **NOTE:** NORMALLY, THE TREND WINDOW IS SET INSIDE THE FAULT LIMIT WINDOW. **NOTE:** WHEN THE VALUE OF A PARAMETER FALLS OUTSIDE THE FAULT WINDOW, BOTH FAULT AND TREND CONDITIONS ARE GENERATED. *Example:* *SOFTQ CURRENT* *SOFTQ CURRENT TREND* *The trend conditions are generated independently only when a parameter value is:* *> than trend limit* *< than fault limit*	1. Verify the SOFTQ current trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. If the SOFTQ Current Trend Fault occurs in conjunction with a Current Regulation or Low Current Limit Fault, then follow the troubleshooting procedure for the respective fault in the manual.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ **RESISTANCE TREND**	FAULT/ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for resistance, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ resistance trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify nothing changed in the weld tooling: • Check for proper tip dress. • Confirm the RMeasure value. 5. If no workpiece is in the gun during Adaptive Mode, the SOFTQ Resistance Trend Fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
***SOFTQ* SEC V TREND**	FAULT/ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for secondary voltage, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ secondary voltage trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify nothing changed in the weld tooling: • Check for proper tip dress. • Confirm the RMeasure value. 5. If no workpiece is in the gun during Adaptive Mode, the SOFTQ Sec V Trend Fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ **ENERGY TREND**	FAULT/ALERT DEFAULT: ALERT	Occurs when the SOFTQ level is setup and enabled for energy, and the number of exceptions that occurred outside the SOFTQ trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ energy trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify the workpiece is in the gun. If no workpiece is in the gun, the SOFTQ Energy Trend Fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT. 5. In Adaptive Mode, verify the weld time is not being extended due to excessive wear on the weld caps: • Open up the windows. • Decrease RATE and WSLIDE where applicable.

<table>
<tr><th>FAULT</th><th>PROGRAMMABLE/ NON-PROGRAMMABLE</th><th>POSSIBLE CAUSE</th><th>SOLUTIONS</th></tr>
<tr><td>SOFTQ HEAT TREND</td><td>FAULT/ALERT

DEFAULT: ALERT</td><td>Occurs when the SOFTQ level is setup and enabled for heat, and the average heat exceeds the SOFTQ hard limit window (either high or low).</td><td>1. Verify the SOFTQ heat hard limit window is set correctly to include all the data in one tip dress or cap life (as applicable).

2. Verify the workpiece is in the gun. If no workpiece is in the gun, the SOFTQ Heat Fault will occur in conjunction with an ADAPTQ TIP TO TIP WELD FAULT.

3. Verify the Sample Size parameter is set correctly for each weld schedule in the RAFT™ Gateway software.

4. In Adaptive Mode, verify the weld time is not being extended due to excessive wear on the weld caps:
• Open up the windows.
• Decrease RATE and WSLIDE where applicable.</td></tr>
</table>

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ C FACTOR TREND	FAULT/ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for c-factor, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ C-factor trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify there is no slag build-up on the gun, shorts between transformer connections or defective diodes in the transformer secondary since these may lead to a High C-factor. 5. Look for any resistance changes in the secondary of the weld tooling. Loose, frayed or incorrect length shunts; loose transformer connections; worn transformer cables; bad or incorrect weld caps are all causes for Low C-factor. 6. Check for proper tip dress. 7. Confirm the RMeasure value.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ T-INTEGRITY TREND	FAULT / ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for T-Integrity, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ T-Integrity trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify there is no slag build-up on the gun, shorts between transformer connections or defective diodes in the transformer secondary since these may lead to a High TI. 5. Look for any resistance changes in the secondary of the weld tooling. Loose, frayed or incorrect length shunts; loose transformer connections; worn transformer cables; bad or incorrect weld caps are all causes for Low TI. 6. Check for proper tip dress. 7. Confirm the RMeasure value.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
SOFTQ WELD TIME TREND	FAULT / ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for weld time, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ weld time trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. In Adaptive Mode, verify the RATE or WSLIDE parameters are not set incorrectly. 5. Verify there are no changes in the welding process or any part disturbances that would cause weld time to be extended. 6. The only way a SOFTQ Weld Time Trend Fault can occur in Constant Current Mode is if the weld time is changed and is longer than it was when the SOFTQ weld time trend hard limit window was set.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
***SOFTQ* P-INTEGRITY TREND**	FAULT / ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for P-Integrity, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ P-Integrity trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify the process envelope is set up correctly in the ***RAFT™*** Gateway software. 5. If a problem still exists, then it is caused by a workpiece disturbance: • Tooling disturbance. • Part disturbance, i.e. excessive gap, stack-up change, etc.
***SOFTQ* N-INTEGRITY TREND**	FAULT / ALERT DEFAULT: ALERT	Occurs when the *SOFTQ* level is setup and enabled for N-Integrity, and the number of exceptions that occurred outside the *SOFTQ* trend limit window (either high or low), exceeded the trend limit while within the trend sample size.	1. Verify the SOFTQ N-Integrity trend limit window is set correctly under normal conditions. 2. Verify the Sample Size parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 3. Verify the Exceptions parameter is set correctly for each weld schedule in the ***RAFT™*** Gateway software. 4. Verify a part disturbance doesn't exist, i.e. excessive gap, stack-up change, etc.

FAULT	PROGRAMMABLE/ NON-PROGRAMMABLE	POSSIBLE CAUSE	SOLUTIONS
WELD PROCESS STOP	FAULT / ALERT DEFAULT: FAULT	Occurs when the part exceeds the SoftQ quality exceptions set in the "Weld Process Stop Limit" in the setup parameters.	1. Check the fault log to establish the cause of the fault. This information will help identify which of the 10 SoftQ quality markers (PI, NI, TI, Heat, Current etc.) recorded quality exceptions. This information can be accessed on the ***RAFT™*** Gateway via: History / Spots / Data / Fault Code. 2. Make an assessment to re weld or skip the fault. 3. The fault can be cleared (like other faults) by clicking the Reset Faults button on ***RAFT™*** Gateway and pressing F5-Reset on the DEP 300s.

TIP DRESS VERIFICATION (TIP CHECK) EXAMPLE USING SOFTQ MONITORING

WHAT IS TIP CHECK ?

- A Tip-to-Tip Constant Current weld, made after a tip dress, that is performed to determine if the tip-to-tip resistance measurement is within a defined range.
- The base value of the range is established early in the cutter blades life cycle.
- As the cutter blades become dull, the resistance measured in the Tip Check schedule increases until it gets out of range.
- As the dress quality deteriorates, the WTC timer generates alerts and faults so that maintenance can address the problem. The fault and alert levels can independently be set as needed.

WELD SCHEDULE

- Set the weld schedule for tip check after establishing the master offset of the tool (R-measure)
- The AdaptQ Mode function is not required in this schedule; if it is present, set Mode = 0 (constant current weld)
- Use the same linear stepper as the production schedules
- Ensure the function EXTEND WELD is NOT used in this schedule; in certain setups, it may trigger a re-weld in case of a problem.

NOTE:
The Red Fault limit is associated with the SOFTQ RESISTANCE parameter
The Yellow Trend limit is represented by SOFTQ RESISTANCE TREND

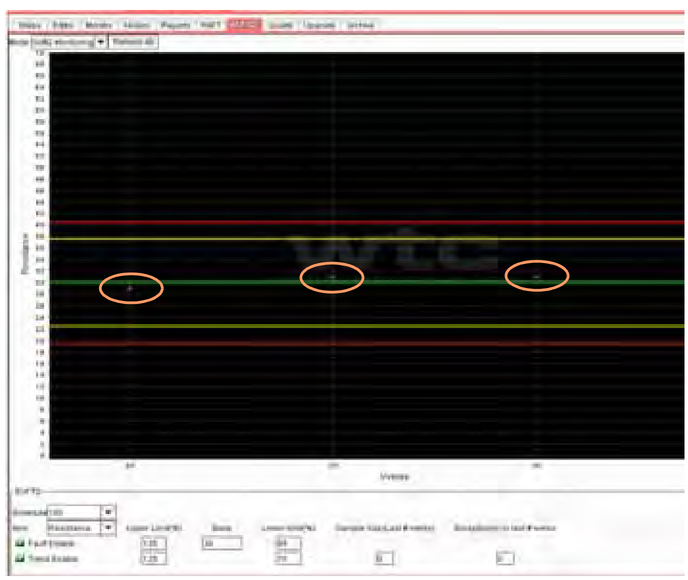
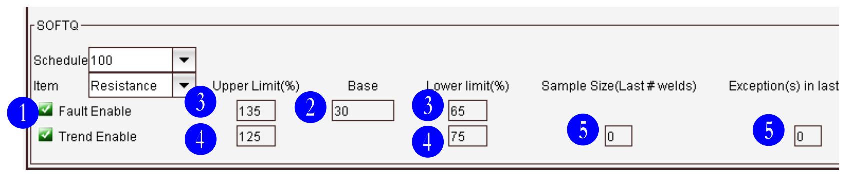


Figure 10.12 SoftQ tab in RAFT Gateway

- Fire the schedule 2-3 times to establish the base value
- The average resistance value is displayed in graph

- Values should be consistent; a gradual increase of resistance usually indicates a cooling problem.

SOFTQ MONITORING – SETUP FAULT/ TREND LIMITS



① Enable the Fault and Trend limits.

② Program the base value – as observed on the first 3 welds made.

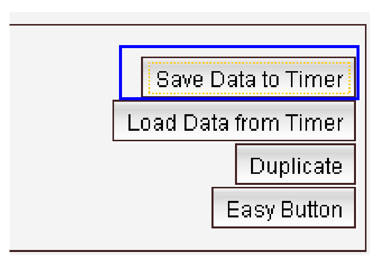
③ Program the upper and lower fault limit – start with 120/ 80 and adjust as needed.

④ Program the upper and lower trend limit – only if needed.

⑤ Program sample size and exceptions values for trend – only if needed.

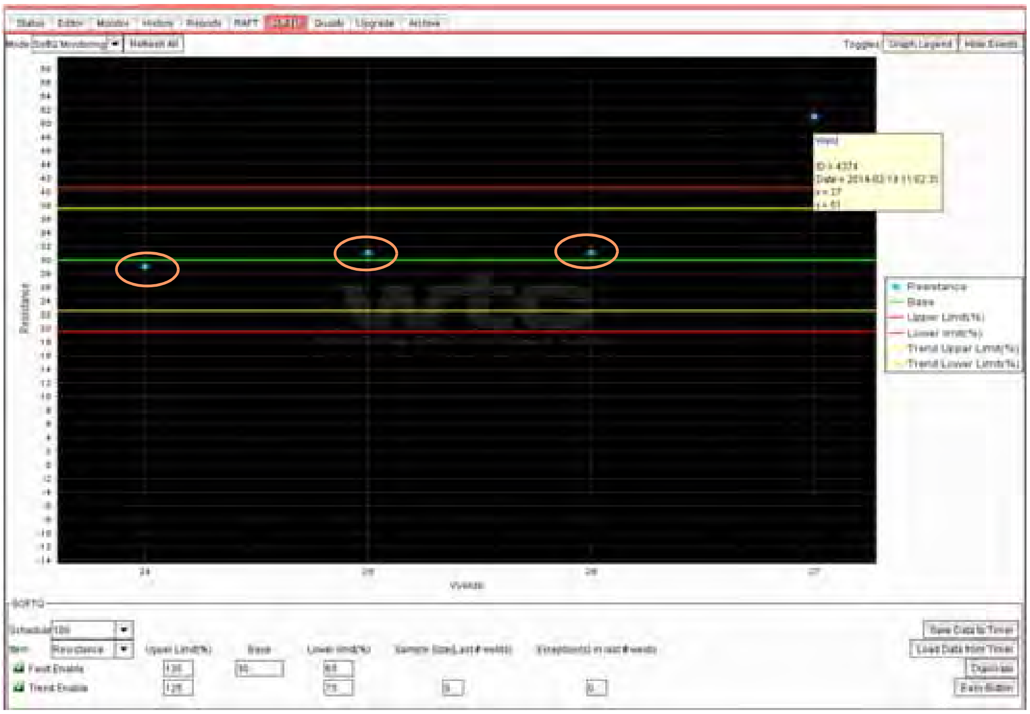
Ex: 1-1 means the condition will be generated for each occurrence.

Ex: 5-3 means that the condition is generated only when there are at least 3 events in the last 5 welds.

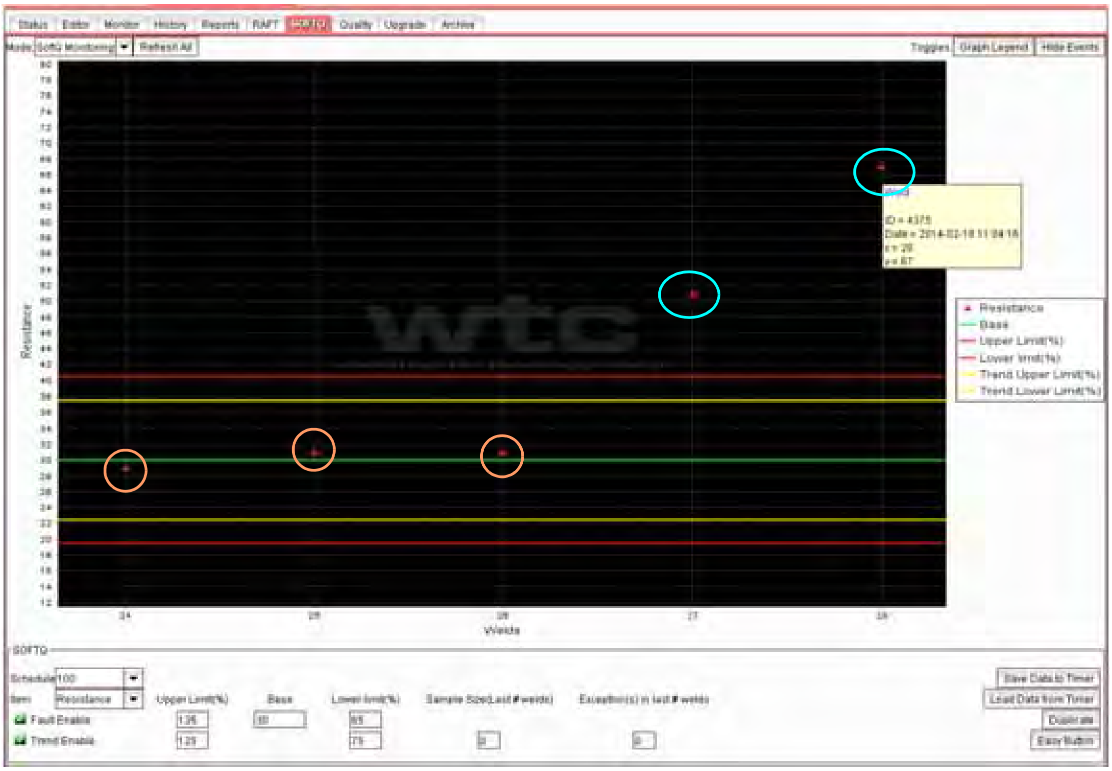


⑥ Save data to timer.

EXAMPLES OF SOFTQ TAB IN RAFT GATEWAY:



Common problem: in the last tip check made, one cap has the face uncut – a Fault will be generated and stop the robot (if SOFTQ RESISTANCE level = FAULT)



In the last tip check made, both caps have the face uncut – a Fault will be generated.

A real tip dress problem and its recovery captured in SoftQ data:

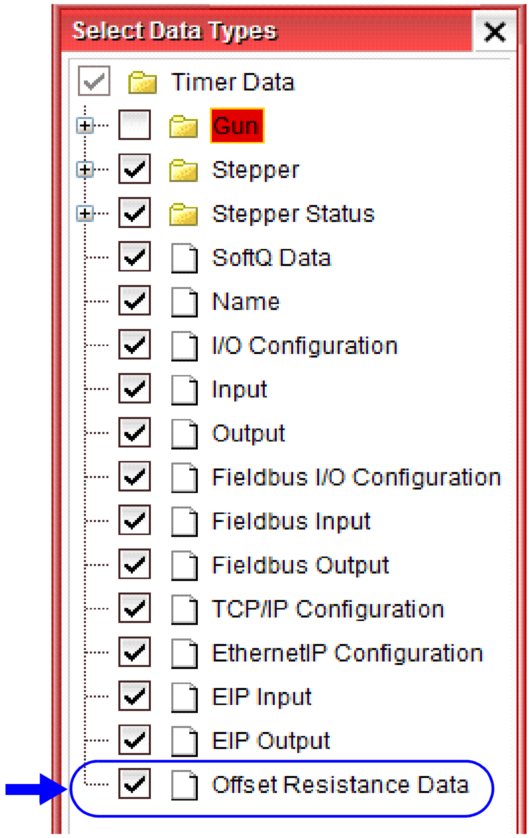
- Once the tip R exceeds the fault limit, the weld control stops the robot process
- Over the next 4 re-tries, the tip alignment in dresser is corrected, the pressure and dress time are increased.
- Finally, the caps are correctly dressed, and the R value returns to normal.

BACKUP AND RESTORE

The data for all guns takes a considerable amount of time and resources to copy. A PC with default RAFT Gateway settings will likely fail to upload all data.

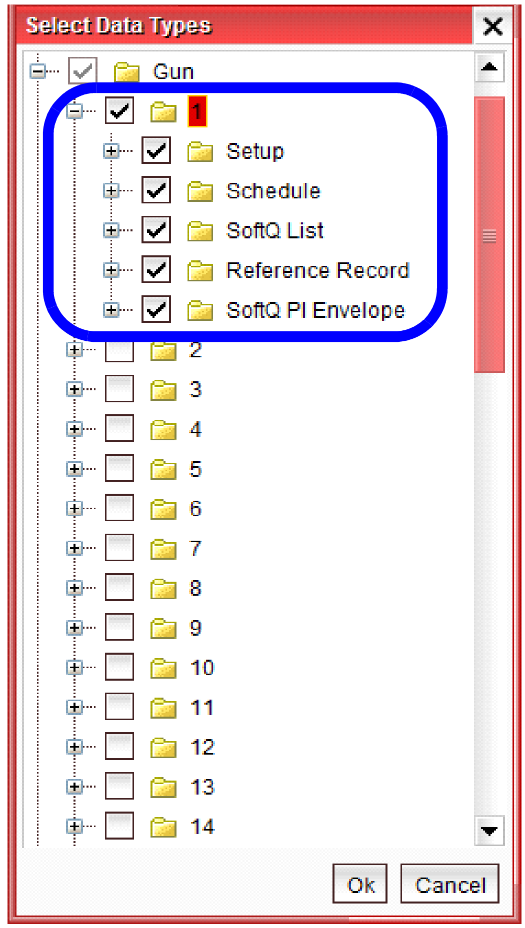
WTC recommends a separate backup is made for:

1. CONTROL DATA:
(Includes all data except gun data)

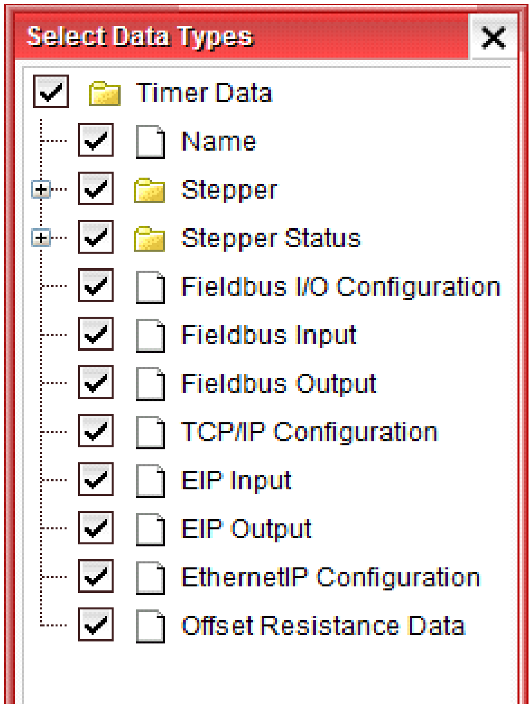


Holds R-Measure data for all guns.

2. INDIVIDUAL GUN BACKUP FILE:
(Includes data for each gun)



AUTO-COMPARE AND BACKUPS



RAFT™ Gateway backups capture only Weld Control Data that includes:

- Stepper Program
- I/O Configuration
- Offset Resistance

AUTO-COMPARE REPORTS DETECT CHANGES ONLY IN THE WELD CONTROL DATA. GUN SPECIFIC DATA IS BACKED UP ON THE SD MEMORY CARD.

Chapter 11: *RAFT*™ LICENSING SOFTWARE

Software A15x50 allows the licensee to enable ***RAFT***™ features upon activation. This is only applicable only to those weld processors that meet the specific hardware requirements. Licensing options available include ***RAFT***™ and *SOFTQ*.

PREQUISITES:

- Internet connection
- Ethernet connection to WT6000 weld processors
- Licensing Software
- Licensing Connection

Once the hardware and software requirements are met the licensing software A15x50 can be installed on a PC connected to all the ***RAFT***™ capable weld processors on the EtherNet.

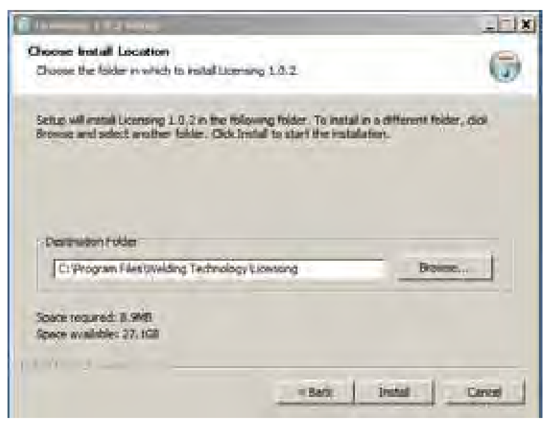
NOTE: Software without a valid ***RAFT***™ license is displayed as A15350 on ***RAFT***™ Gateway and DEP 300s.

WELD PROCESSOR FIRMWARE FEATURES AVAILABLE		
SOFTWARE VERSION	***RAFT™***	**SOFTQ**
A15250		✔
A15350		
A15450	✔	
A15650	✔	✔

SETUP PROCEDURE

① Double click the WTC Licensing link provided. This opens up the installation wizard. Click Next to proceed.

② Click “I Agree” to accept the terms of the next 5 license agreements.



③ By default the software is installed in the Program Files folder. If required, change the location of the destination folder and click Install.

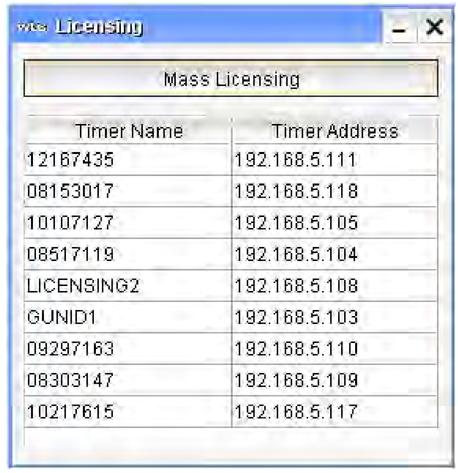
④ Click Finish to complete the installation.

The licensing software is now available and ***RAFT***™ *features can be enabled for a specific or a group of weld processors available on the EtherNet.*

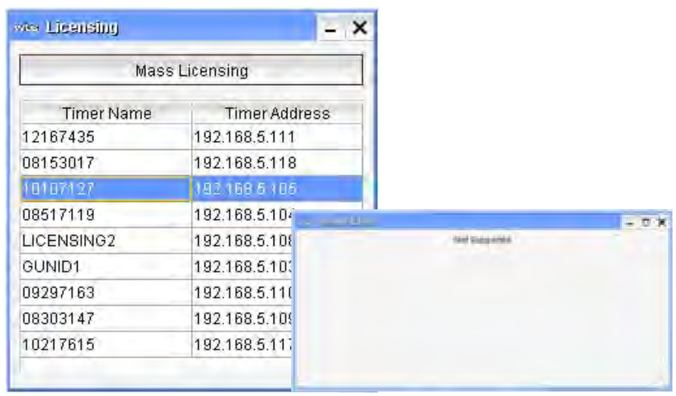
LICENSING INTERFACE AND SETUP

The steps below list the process of Mass Licensing.

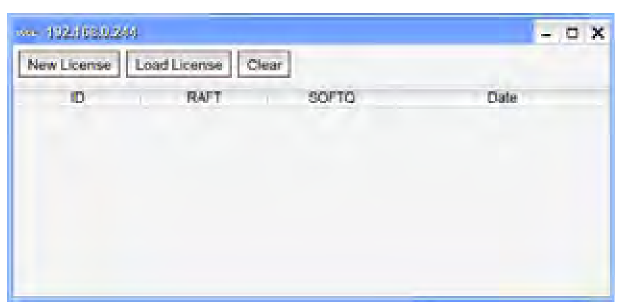
① Double-click the WTC Licensing icon on the desktop.



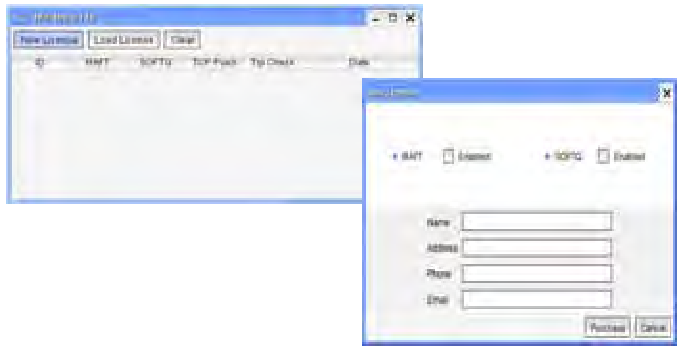
② The application will generate a list of on-line timers. Double-clicking a timer will launch an interface for the timer.



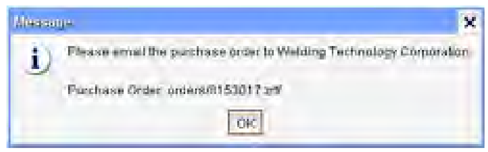
③ Unsupported timers will display a “Not Supported” message.



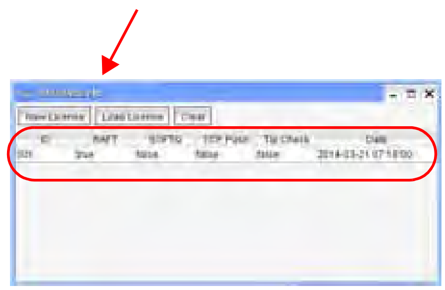
④ Double-clicking a supported timer will display the above window. A fresh timer will have no history.



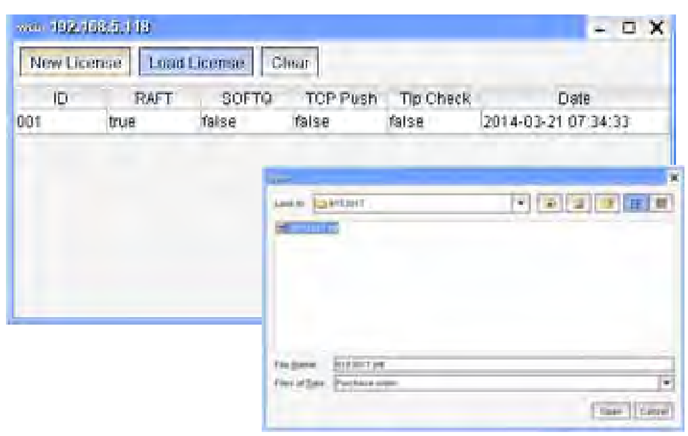
⑤ Click the New License button to open the features dialog box. Check the desired features to enable and click the Purchase button.



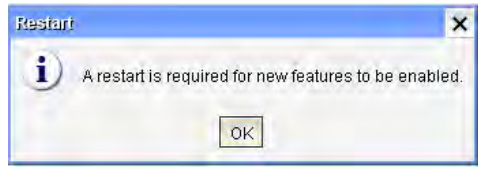
⑥ A dialog box opens to display the order key number which needs to be emailed to WTC.



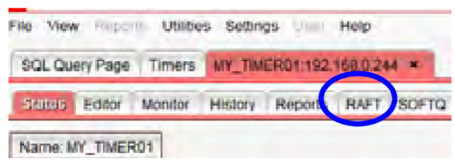
⑦ Clicking the OK button opens the previous interface where the new history is displayed.



⑧ Once the License Key is received click the Load License button.



⑨ After uploading the license a prompt is displayed to restart. Restart ***RAFT***™ Gateway and cycle power on the timer to complete the process.



NOTE: THE RAFT TAB IS VISIBLE AT ALL TIMES IN ***RAFT***™ GATEWAY EVEN WHEN LICENSES HAVE NOT BEEN ACTIVATED. GRAPHING IS THE ONLY FEATURE AVAILABLE WITHOUT AN ACTIVE LICENSE. THE "CREATE REFERENCE" AND "R MEASURE" BUTTONS ARE GHOSTED OUT AND INOPERATIVE WHEN NO LICENSES ARE ENABLED.

Chapter 12: PREVENTATIVE MAINTENANCE

WARNING!

UNLESS DESCRIBED OTHERWISE, MAINTENANCE WORK MUST BE PERFORMED ON INACTIVE SYSTEMS THAT HAVE BEEN SUFFICIENTLY PROTECTED AGAINST RE-CLOSING!

WARNING!

MEASURING OR TEST ACTIVITIES THAT MIGHT BE NECESSARY ON THE LIVE SYSTEM ARE RESERVED FOR QUALIFIED ELECTRICAL PERSONNEL.

WARNING!

INSULATED TOOLS SHOULD BE USED FOR ALL WORK ON ELECTRICALLY CONDUCTIVE PARTS.

WARNING!

PLEASE NOTE THAT THE VOLTAGE INSIDE THE UNIT DIRECTLY AFTER SWITCHING OFF THE MAINS SUPPLY HAS NOT BEEN REDUCED TO A HARMLESS LEVEL YET. CHECK WITH A KNOWN GOOD MULTIMETER TO CONFIRM THERE IS ZERO VOLTAGE ON THE PRODUCT.

WARNING!

DO NOT TOUCH EITHER MAINS OR TRANSFORMER CONNECTIONS FOR AT LEAST 5 MINUTES AFTER SWITCHING THE MAINS SUPPLY OFF.

THE FOLLOWING CHART CAN BE USED TO DESIGN A PREVENTATIVE MAINTENANCE SCHEDULE FOR THE ENTIRE WELD CONTROL.

FREQUENCY	ACTION	CABINET POWER?
Monthly	**GENERAL**	✕
	Conduct a general inspection of mechanical integrity. In particular, take note of any fractured or loose bolts, missing parts or loose connections.	
	Remove any accumulated dust and dirt from the enclosure. Use a vacuum cleaner fitted with an insulated nozzle or brush *without* exposed metal. DO NOT use compressed air to blow out dust.	
	Inspect all moving parts for wear and to assure that they move freely without binding or sticking. Replace any parts or devices if doubtful performance is observed.	
	Check and replace contact springs if the spring force has been reduced, or if evidence of burning or overheating appears.	
	Inspect all insulating parts. Replace any broken or badly eroded part(s). Remove any easily dislodged metal dust or granules. **DO NOT SCRAPE INSULATING SURFACES.**	
	Inspect the enclosure for evidence of deterioration. Remove any accumulated dust or dirt from the top of the enclosure before opening doors or removing covers.	
Monthly	**ISOLATION CONTACTOR**	✔
	Ensure that the Contactor operates properly. Contactor should turn OFF/ON smoothly.	
Monthly	**CIRCUIT BREAKER**	✔
	Test shunt trip button on circuit breaker.	

FREQUENCY	ACTION	CABINET POWER?
3 Months	**MOUNTING BOLTS** Conduct a general inspection of mechanical integrity. Verify all mounting bolts holding the cabinet in place are tight.	✕
3 Months	**CABLES & CONNECTIONS INSIDE WELD CABINET** Examine flexible cords and connectors. Make certain that cords are free from abrasion, cracks and exposed strands. Also, verify the integrity of all connectors. Verify that live parts are not exposed. Verify tight connections and that internal cables show no wear.	✕
3 Months	**CABLING OUTSIDE CABINET** External cabling should be secure and show little to no wear.	✔
3 Months	**WATER COOLING SYSTEM** Check for any signs of moisture, or any previous wetness or dripping. Replace or thoroughly dry and clean any insulation material which is damp or wet, or shows any accumulation of deposited material from previous moisture. Inspect water-cooling circuit for leaking fittings, hoses, etc. Inspect for worn or cracked hoses and replace as required. Ensure all hose clamps are tight. Check for proper water flow in accordance with specifications in Chapter 1. (Water-Cooled models only)	✔
3 Months	**TERMINALS & TERMINAL STRIPS** Inspect all terminals, fuse clips and connections for evidence of loosening or overheating. As necessary, clean contact surfaces. Tighten or replace any loose terminations. All screw connections should be tightened.	✕

FREQUENCY	ACTION	CABINET POWER?
3 Months	**FUSES AND FUSE TERMINALS** Check all fuses and circuit breakers for the proper ratings. NEVER replace current limiting fuses with fuses that are not current-limiting. NEVER try to defeat rejection mechanisms designed to prevent installing the wrong type of fuse. Inspect for damaged fuses and ensure that fuses fit properly in holders.	✕
6 Months	**INVERTER COOLING FINS AND FANS** Keep ventilation passages open. Remove dust build-up between inverter cooling fins and within air circulation fans. WTC recommends using compressed air to remove dirt. Ensure fans are functioning properly. (Air-Cooled models only)	✔
12 Months	**EXTERNAL CABINET** Inspect for damage external to cabinet and that labels are intact.	✔
12 Months	**CABINET DOOR** Inspect that door opens and closes smoothly and that seals are not cracked or broken.	✔
12 Months	**LED'S & LAMPS** Inspect for damaged LED's or warning lamps internal and external to the weld controller.	✕
12 Months	**WELD CONTROL GROUNDING** Verify weld control cabinet is properly connected to earth ground, using either a multimeter or other suitable test equipment.	✕

NOTE: AFTER ANY INSPECTION, MAINTENANCE OR REPAIR OPERATION, REMOVE THE GROUNDING CHAINS FROM POWER CIRCUITS. TAKE ANY STEPS REQUIRED TO PREVENT HAZARDS TO PERSONNEL WHEN REAPPLYING POWER TO THE UNIT.

REPAIR AND REPLACEMENT

Perform these steps when repairing or replacing equipment:

- Verify that every replacement part complies with the manufacturer's recommendations.
- Inspect all replacement parts for any evidence of deterioration due to storage or shelf life.
- Check for signs of rework or wear which may involve factors critical to safety.

CALIBRATION AND SERVICE

The MFDC inverter assembly (housed in the weld enclosure) is calibrated and certified as part of the production process. All calibrations are electronic, performed on the inverter chill plate and associated electronics.

Certified replacement inverter assemblies are available from WTC. Stock these as replacement parts.

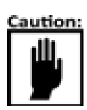
Service kits are available from WTC at additional charge.

Contact WTC for spare parts information:

WTC Industrial Technical Services
Phone: +1 248-477-3900 | Fax: +1 248-477-8897
Email: service@weldtechcorp.com
Website: www.weldtechcorp.com

PROCEDURE TO UPGRADE FIRMWARE IN A SINGLE WT6000 TIMER MODULE FROM *RAFT* ™ GATEWAY

WTC weld controls require different firmware (software) for the various manufacturing applications they are used for. WTC regularly releases new firmware versions to improve product performance and add new features. To upgrade a weld control with a specific firmware version follow these instructions.



IMPORTANT

BEFORE INITIATING AN UPGRADE ON EQUIPMENT CURRENTLY RUNNING PRODUCTION, IT IS IMPORTANT TO REVIEW THE STEPS LISTED IN THE PROCEDURE BELOW AND FOLLOW THE PROCEDURE PRECISELY.

1. Backup the Timer
2. Compare the Backup
3. Flashing the Firmware
4. Reload Defaults
5. Download Backup
6. Cycle Power
7. Compare Again
8. Qualify the Timer

PREPARATION:

REQUIRED ITEMS:

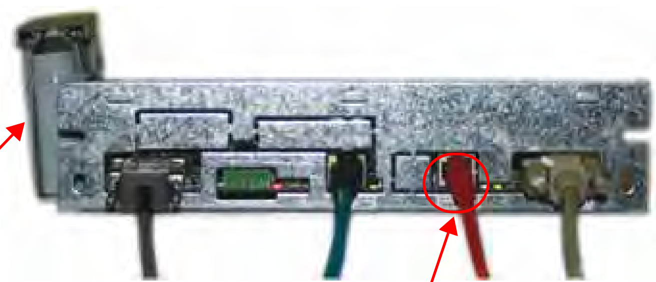
1. WTC weld Timer.

2. Access to power.

3. WTC certified valid firmware for upgrade.

4. Workstation or laptop connected to the timer locally or via plant Ethernet.

Timers can be flashed with new firmware on the test bench or while inserted in the inverter on a weld control as long as you have access to power. Depicted below is a timer on a test bench, powered by 24VDC power supply via a ribbon cable and an Ethernet CAT cable plugged into the local Ethernet port.



Power Supply-24VDC Output

Ethernet Cable from computer to timer local Ethernet port (89.89.200.250)

Timers can also be flashed via the Ethernet IP port using the address programmed by the plant network configuration.

PROCEDURE TO FLASH A WELD TIMER USING *RAFT™* GATEWAY.

1. BACKUP THE TIMER

Caution:

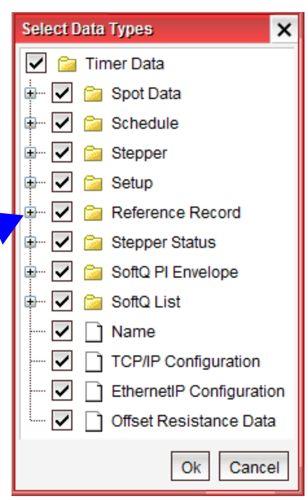
BEFORE BEGINNING ANY UPGRADE PROCEDURES, MAKE SURE TO BACK UP ALL EXISTING SETUPS AND CONFIGURATION RELEVANT TO THE EQUIPMENT.

BACKUP PROCEDURE:

The user can create a manual backup to a location of their choice from any individual weld timer tab.

1. From the Timer Status Panel click the "Upload: Timer to File" button.

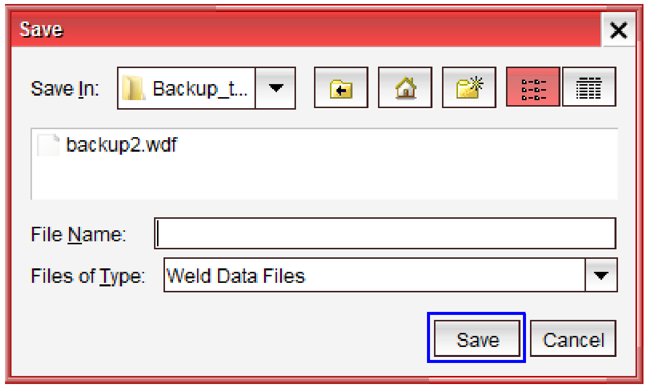
To expand a list click the "+" symbol



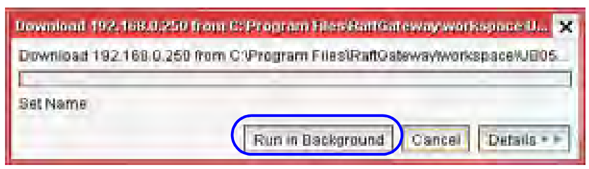
By default, all data types are checked will be backed up, unless otherwise changed by the use

2. This opens the Select Data type dialog box. Select all data that needs to be backed up by clicking the applicable check boxes.

3. After the data types are selected, click “OK”. A Save dialog box appears prompting the user to enter a file name and select a location where the backup file (WDF) will be saved (see below). Name the file and click “Save”.



4. Clicking the Save button will begin the upload process which is shown in the progress box. ***RAFT™*** Gateway will then take the data, convert it into a WDF file and save it to the selected file location.



5. The progress bar that appears to show the status of the upload contains three options for the user:

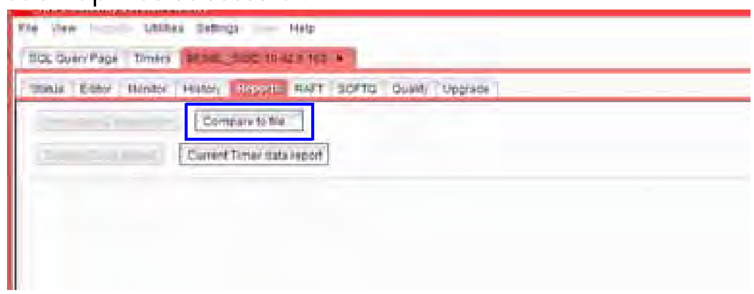
Run in Background: Provides the option of performing other tasks while the data is uploaded. When Run in Background is selected, the upload box disappears and the progress bar is displayed at the bottom of the status screen. if another timer tab is opened, the progress bar will not be carried over- it is designed to show processes for the selected timer only.

Cancel: Abort the upload / download of weld timer data.

Details: if multiple items are running at the same time, click this button to see a detailed progress of all operations.

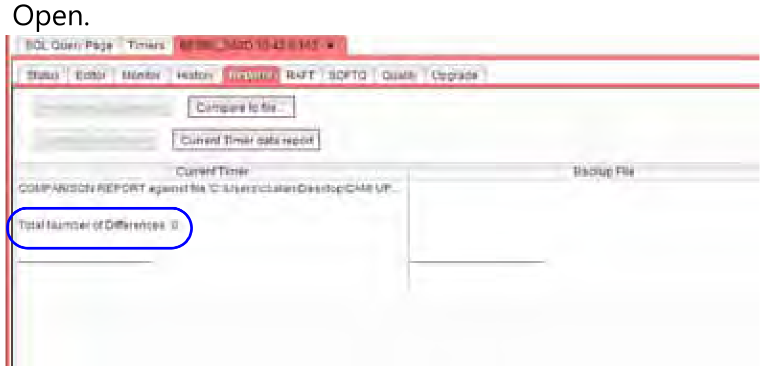
2. COMPARE THE BACKUP

Before proceeding any further with the upgrade process, compare the back-up file with actual timer data to verify that the back-up was successful.



1. Go to the Reports tab and Click on “Compare to file”.

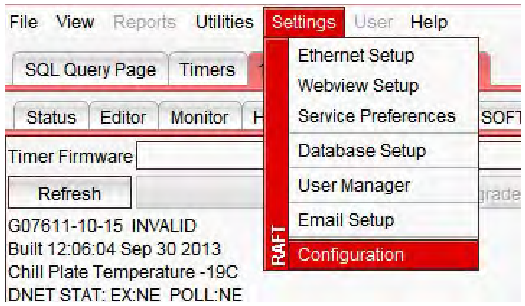
2. In the new window select the file previously created and click Open.



3. Once the compare process is complete make sure there are no differences between the backup file just created and the timer data. if any differences are found, the backup file has to be recreated.

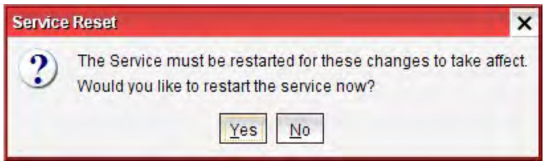
3. FLASHING THE FIRMWARE

The upgrade panel allows the user to upgrade the software when required. This tab is hidden by default. To activate, perform the following steps.
If the tab is visible skip to **"Procedure to upgrade the software" on page 333**

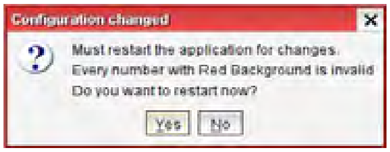


1. Click on Settings in the top menu bar. This opens up an expansion box. Select Configuration.

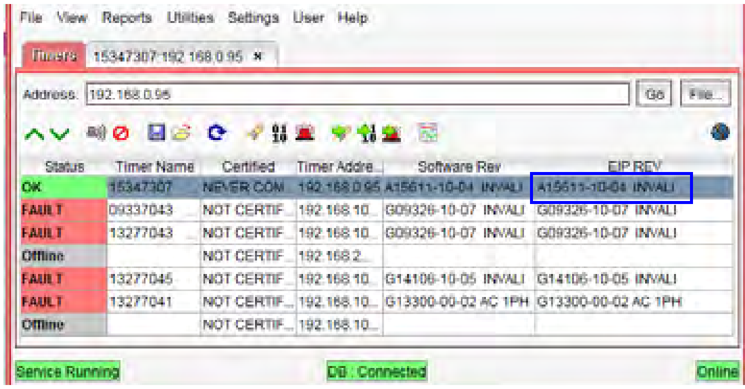
2. Click the check box for the Upgrade Panel to Enabled and then click Save to apply the change.



3. A Service Reset dialog box will appear. Click the Yes button to restart the Services and for the changes to take effect.



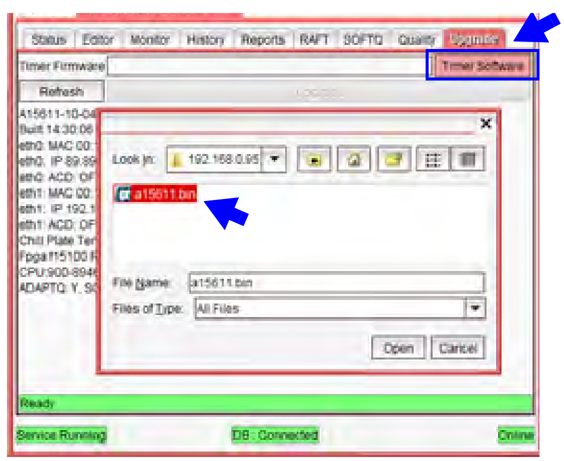
4. A Configuration Changed dialog box will appear. Click the Yes button for the changes to take effect and re-start ***RAFT***™ Gateway.



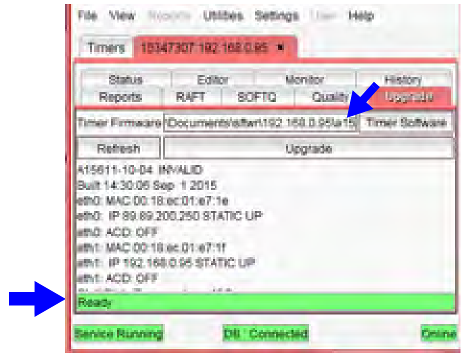
5. After ***RAFT***™ Gateway re-starts, double-click the desired timer from the Timers window to open the timer tab.

In the example above the timer has firmware A15611-10-04 however since it is powered on the bench and not within an inverter, it is labeled INVAL to indicate inverter type. In the case of a timer that is within a weld control the word INVAL would be replaced by the specific inverter ID.

PROCEDURE TO UPGRADE THE SOFTWARE



1. Notice that the Upgrade tab is now visible. Click on the Timer Software button. This opens a dialog box with available files. Use the drop down menu to locate the folder containing the upgrade file. Then click the Open button.

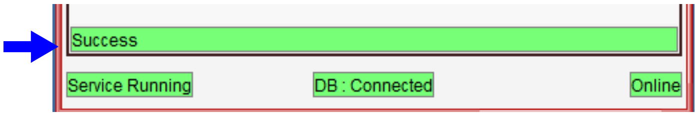


2. The file path will appear in the window and the status bar at the bottom of the screen will turn green and display "Ready". Click the Upgrade button to begin the process.

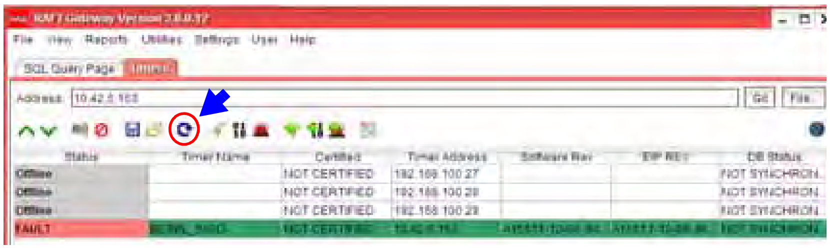
   The upgrade process will typically take around 2 minutes and at the end the CPU will cycle power automatically to conclude the flashing/upgrade procedure.

Caution:

DO NOT REMOVE POWER TO THE WELD CONTROL OR BEGIN ANOTHER SOFTWARE UPGRADE DURING THIS TIME. WAIT UNTIL "READY" CHANGES TO "SUCCESS" AT THE BOTTOM OF THE SCREEN.

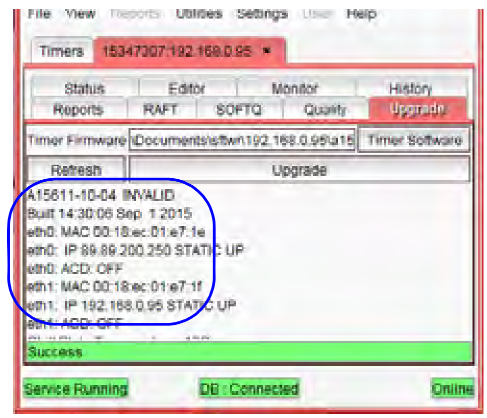


Look at the LED's on the face of the weld timer for the progress of the software upgrade. During this process, the LED's will flash and then turn off. When they begin to flash in sequence again from left to right, you know that the software has been upgraded. This is also confirmed with the message at the bottom of the screen that turns from "Ready" to "Success".



3. Close the present timer tab and click the "Refresh" icon on the Timers screen. Find the upgraded timer in the refreshed list and click to select.

4. The updated timer will display a “RAM Data Failure” fault (which is normal). Click Reset Faults to clear the fault.



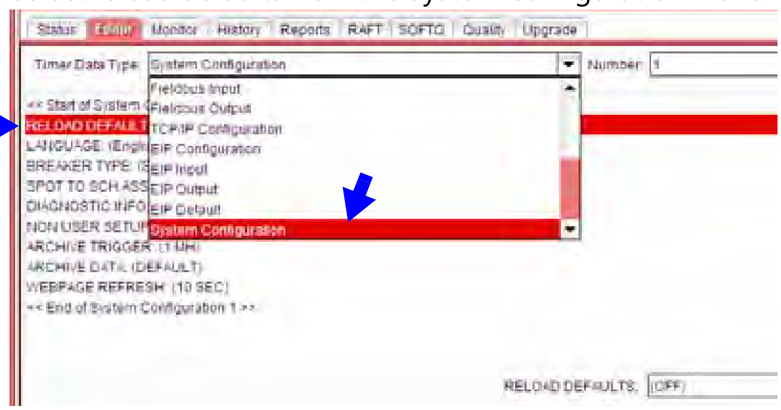
Navigate to the Upgrade tab and verify that the new firmware version is displayed.

4. RELOAD DEFAULTS

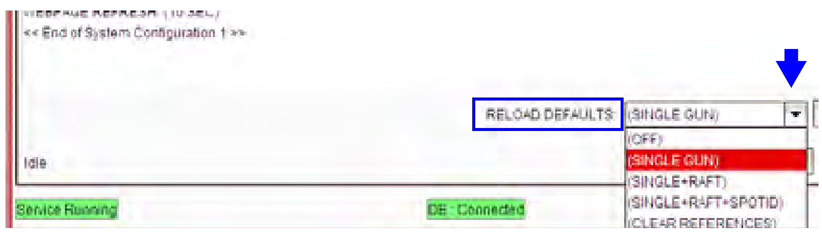
Reload defaults to configure the timer for the new software. This is performed from two locations:

SYSTEM CONFIGURATION

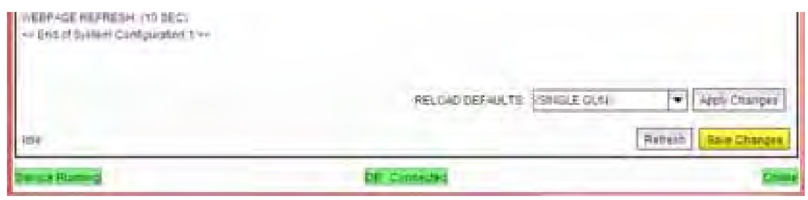
First select reload defaults from the System Configuration menu:



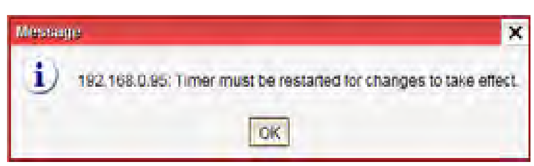
1. Click on the Editor tab and select System Configuration from the drop down menu. Select RELOAD DEFAULT from the System Configuration screen.



2. Click the down arrow at the lower right of the screen to display the options for RELOAD DEFAULT. Make your selection from this list.



3. Click Apply Changes. The Save Changes button will turn yellow to indicate a change has been made. Click Save Changes.

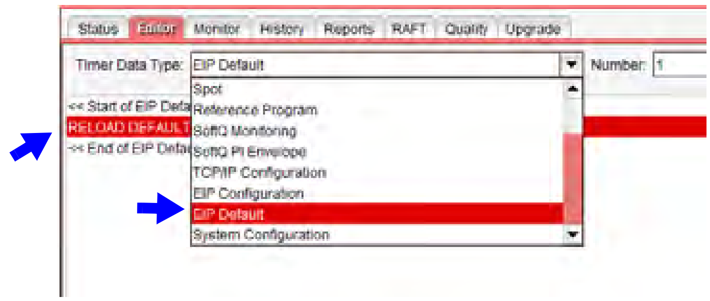


4. You will be prompted to restart the timer. Cycle power to the timer to complete this step.

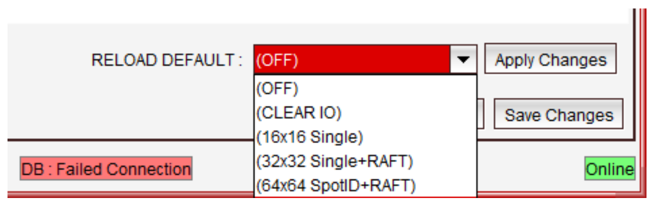
EIP I/O DEFAULTS

EIP defaults allow the operator to load features of the Ethernet/IP card. Depending on the software options available in the weld timer, different features may be displayed on the EIP Default screen.

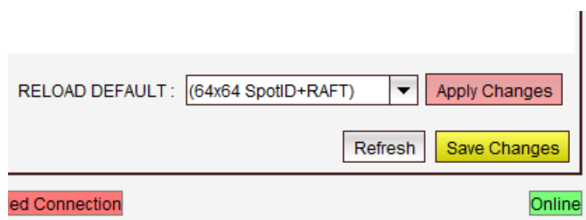
Select defaults from the EIP Defaults menu:



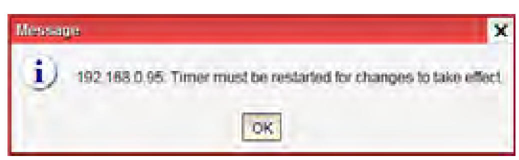
1. From the Editor tab select EIP Defaults.



2. Click the down arrow at the lower right of the screen to display the drop down list of options available under RELOAD DEFAULT. Make your selection from the EIP defaults here.



3. Click Apply Changes. The Save Changes button will turn yellow to indicate that a change has been made. Click Save Changes.

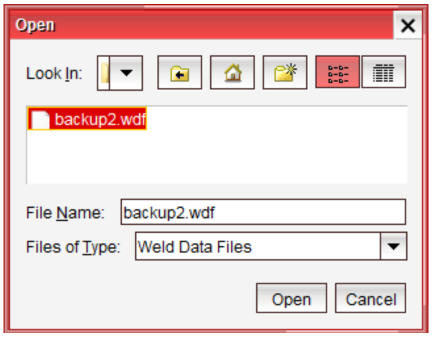


4. You will be prompted to restart the timer. Cycle power to the timer to complete this step.

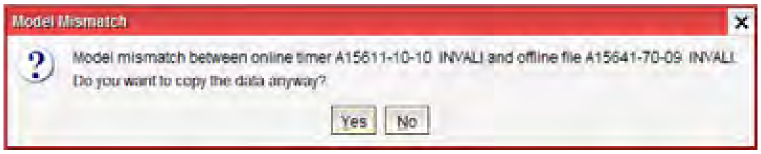
5. DOWNLOAD BACKUP

At this stage the timer is ready for the backup file that was created earlier.

1. From the Status tab click DOWNLOAD file to timer button.

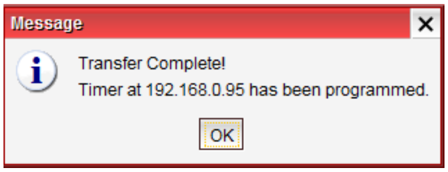


2. This opens up the save dialog box. Select the file that was created earlier and click Open.



3. This will bring up a warning message alerting the operator to ensure that the change is intended. Click Yes.

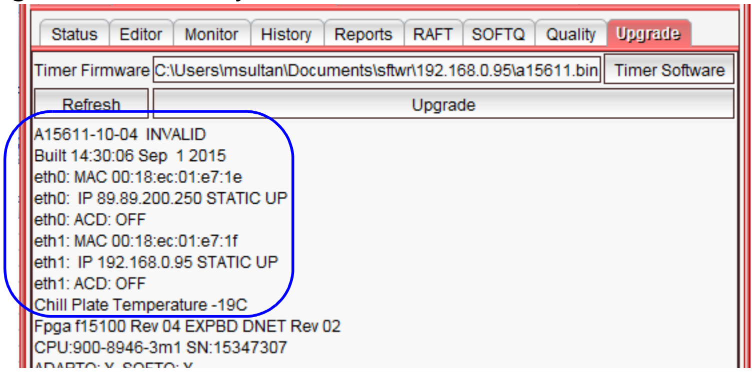
4. This brings up another warning message to make sure that the operator knows there is a change being made before proceeding. Click Yes.



5. A confirmation will be displayed after the transfer is complete.

6. CYCLE POWER

Cycle power to the weld control to apply the changes. When ***RAFT***™ Gateway re-starts with the new firmware double-click the timer that was just upgraded to open the timer tab. Click the Upgrade tab to verify the software version.



NOTE:

IN SOME CIRCUMSTANCES, THE WELD TIMER MAY NOT PROPERLY RE-INITIALIZE AFTER THE SOFTWARE UPGRADE IS COMPLETE. WHEN THIS OCCURS, THE LED'S WILL TURN SOLID RED INSTEAD OF RETURNING TO A NORMAL FLASH PATTERN. TO CORRECT THIS, MANUALLY RE-INITIALIZE THE WELD TIMER BY CYCLING POWER ON THE WELD CONTROL CABINET.

7. COMPARE AGAIN

Now compare the file that was *just uploaded* to the upgraded timer with the *previously created backup file* that includes all relevant operation setups.

To run the comparison, click the Reports tab, and then click the Compare to file button. From the dialog box that opens select the backup file previously created and click Open.

The report will display any differences due to the new functions and setup associated with the new software. This is especially true when changing to a completely new application software. Close the timer tab.

8. QUALIFY THE TIMER

Qualify the operation of the timer for production. With this step the firmware upgrade procedure is complete.

ABOUT WELD DATA FILES (.WDF)

A Weld Data Format (.WDF) file is a proprietary file format developed by WTC specifically for the ***RAFT***™ Gateway Network & Data Collection Software. The ***RAFT***™ Gateway Software takes the raw data from the weld timer and converts it into a format, which can be conveniently viewed, edited, manipulated and transported by the user.

NOTE 1: .WDF files can only be viewed in the ***RAFT***™ Gateway software application. They can not be viewed in Microsoft NotePad, Word, Excel, etc.

NOTE 2: When restoring a weld data file (WDF) to a weld timer, it is not always necessary to cycle power to the cabinet.

Changes that require a power cycle:

- Changes to I/O mapping (Any type - EIP, DNet, DIO, SIO)
- Changes to EtherNet or network settings
- Changes to some Setup Parameters
- Changes to transfer size, speed or node address
- Changes to language and system configuration

Changes that do not require a power cycle:

- Changes to the weld schedules
- Changes to some Setup Parameters
- Changes to Steppers
- Changes to timer name (Welder ID)

GLOSSARY

ADAPTIVE WELDING
Integrates advanced controls with current, voltage and resistance monitoring to automatically adjust welding time and current to ensure each weld is executed to the highest quality.

ADAPTQ
Changes weld current and weld time to provide the required nugget diameter over process disturbances while greatly reducing expulsion.

C-FACTOR
C-Factor (or Capacity Factor) is a parameter, which is used to track changes in the weld tooling. C-Factor is calculated by determining the amount of total capacity utilized to create the target current and dividing this value by the actual current created. The C-Factor feature can be used as a maintenance tool to monitor weld tooling degradation and current shunting paths (primary or secondary).

CIRCUIT BREAKER
Supplies or interrupts line voltage to the entire weld control cabinet.

CONTROL TRANSFORMER
Steps down line voltage to 120V and 24V for the cabinet power.

COMM
RS485 Serial Interface. COMM is used for DEP-300s or DEP-100S data entry panel communications.

CREATE REFERENCE (WHEN ENABLED FROM SETTINGS > CONFIGURATION)

Allows ***RAFT***™ Gateway to create references from welds.

DATABASE

The ***RAFT***™ Gateway Database is located in Workspace path under the db folder.

- The database stores a list of all weld processors that have been configured in the .ini file.
- Each weld processor is assigned a unique ID which is a combination of the IP address of the PC and the weld processor.
- The database creates tables for weld summary and graphs found under the History tab. This information is used for SoftQ monitoring and creating the PI envelope.
- The database stores User Login information.
- By default, the database purges data every 7 days which can be reconfigured with a different time to suit specific plant requirements. It is recommended to set the time frame during non-production hours since the process can slow down operations.

DELAY

Delay functions are used to cause a wait time to occur for a specified amount of time

ETHERNET

A port on the weld processor used for standard Ethernet communications.

ENET IP

A port on the weld processor used for I/O communication between the weld timer and other EtherNet IP (Industrial Protocol) enabled devices (e.g. a Robot or PLC). Also used to communicate with Weld Gateway and RAFT Gateway networking software.

EVENT DATA

Record of all events or actions that occurred during the welding process for example a schedule change or Stepper Reset.

EXTENDED

Extended functions are used to extend a particular function within a schedule until certain conditions are met.

FAULT DATA

A record of changes in the welding process that is annunciated with three levels of alerts - Fault, Alert and None.

FIELDBUS I/O

Configuration of FieldBus input output of the weld processor. FieldBus network system is a real-time distributed control for industrial networks. FieldBus works on a network structure which typically allows daisy-chain, star, ring, branch, and tree network topologies. FieldBus communication scheme gives the weld processor the ability to control and allow multiple analog and digital points to be connected at the same time.

GRAPH DATA
Graphical representation of welding data.

HOLD
Apply wait time after the weld current stops to allow the nugget time to cool.

INVERTER ASSEMBLY
Converts three-phase (50/60HZ) AC line voltage to single-phase (1000HZ) AC.

ISOLATION CONTACTOR
Located downstream of the inverter to interrupt current to the MFDC welding transformer.

.INI FILES
INI files are simple text files with a basic structure composed of “sections” and “properties”.

.JAR FILE
Java Archive package file.

MASS UPGRADE
Collective software upgrade/update for multiple weld processors.

UPGRADE WELD PROCESSOR SOFTWARE
Software upgrade/update for selected weld processor.

NI -NUGGET INTEGRITY
NI is the confidence factor of an acceptable nugget. NI is calculated from Total energy, R-drop, R-peak, R-curve, Total Heat, current and weld time of the subject weld as compared to the reference weld.

PART ID
A unique number generated in increments by the weld processor to identify each weld on the data collected.

PI - PROCESS INTEGRITY
PI identifies the magnitude of disturbances in the welding process.

PI ENVELOPE
Defines the upper and lower limits for the PI (Process Integrity) data collected.

R AVG
The resistance average of the last weld in micro ohms.

R DROP
The resistance drop percentage during the last weld.

***RAFT*™ GATEWAY NETWORK SOFTWARE**
Manages and monitors WTC resistance welding controls.

***RAFT*™ GATEWAY CERTIFIER PROGRAM**
A mini-application that creates certified backup files.

RAFTGATEWAY.INI
A very important application file that should not be edited unless instructed by WTC personnel.

REFERENCE WELD
A constant current weld without expulsion or other disturbances that provides a base line of information for AdaptQ and SoftQ. A Reference Weld has to be performed for every schedule.

REFERENCE PROGRAM
The list of parameters of the reference weld, as shown by the ***RAFT*™** Gateway.

SCHEDULE
A (Weld) Schedule is a list of commands or functions which are used to instruct the weld processor to deliver a combination of heat (weld current) and time (weld time) to the weld interface to create a weld nugget.

SEC I/V
Secondary Current or Voltage Monitoring Input (Optional). Location for input wires for Secondary Current or Secondary Voltage Monitoring.

SERVICE STATUS
Displays the connectivity status of the Data Monitoring Services.

- Service Running: Indicates the services have been enabled and the weld data will be collected by ***RAFT***™ Gateway.
- Service Not Running: Indicates that the services have stopped and data will not be collected.

SLOPE
Slope functions are used to provide either a linear increase or decrease in welding current for a specified length of time.

SOFTQ™
A comparison of the last weld data with the reference weld that calculates the PI (Process Integrity) NI (Nugget Integrity) and TI (Tooling Integrity). SoftQ™ functions in both constant current and

adaptive mode, as long as a reference weld is captured for each schedule the user intends to monitor.

SPECIAL (FUNCTIONS)
Special functions are used to create special conditions within the weld schedule.

SPOT
Another name for a weld.

SPOT ID
User assigned unique identification number that defines a specific spot created with a weld schedule. This feature is only available with certain software.

SSPI
WTC Proprietary I/O Communication Protocol (Optional) SSPI supports communication with optional WTC I/O peripheral devices.

STATION ID
User defined identification number for the weld interface.

SQUEEZE
Apply pressure (electrode force) to the weld interface.

TCP/IP
Transmission Control Protocol (TCP) and the Internet Protocol (IP), provide end-to-end connectivity specifying how data should be formatted, addressed, transmitted, routed and received at the *RAFT*™ Gateway. This functionality establishes inter networking and provides process-to-process application data exchange.

V AVG
Average secondary voltage drop of the last weld.

WELD
Deliver weld current to the weld interface.

WELD DATA
Data collected by ***RAFT***™ Gateway from the weld processor that provides detailed information on the welding history of the specific weld processor.

WELD ID
A unique identification number generated to identify certain part/body/assembly number in the weld data collected. Weld ID bits are used in software A15x71 to select the gun # whose parameters (weld schedules, setup) will be loaded in memory at the next gun change.

WELD TIMER ASSEMBLY (PROCESSOR)
The weld processor is the “brain” of the weld control.

It controls all communications, I/O, programming of weld schedules, setup parameters , etc.
It generates and interprets all hardware commands and feedback signals in the inverter, executes all weld schedules and generates fault/ alert conditions as programmed.

WEBVIEW

An interconnect between the ***RAFT***™ Gateway and WTC legacy weld timers that use either serial networks or are otherwise not compatible with the ***RAFT***™ Gateway.

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