

INSPIRED INNOVATION

Despatch
INDUSTRIES

PROTOCOL 3™ Controller OWNER'S MANUAL

E-105
PN 313327
VERSION 1.2
6/2013

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INDUSTRIES

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1.1	3/2013	K. Livingston	Modified instructions for delayed start and remote communication. Modbus User's Programming Manual added (E-106/ PN320813, Version 3/2013, Updated for Engineering Issue 8).
1.2	6/2013	K. Livingston	Minor edits

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1. About This Manual

1.1. Important User Information


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Printed and bound in the United States of America.

The information in this manual is subject to change without notice and does not represent a commitment on the part of Despatch Industries. Despatch Industries does not assume any responsibility for any errors that may appear in this manual.


In no event will Despatch Industries be liable for technical or editorial omissions made herein, nor for direct, indirect, special, incidental, or consequential damages resulting from the use or defect of this manual.

	<p><i>Values displayed on screens are examples only. Though those values may be typical, contact Despatch Industries for the final value.</i></p>
---	--


	<p><i>Users of this equipment must comply with operating procedures and training of operation personnel as required by the Occupational Safety and Health Act (OSHA) of 1970, Section 6 and relevant safety standards, as well as other safety rules and regulations of state and local governments. Refer to the relevant safety standards in OSHA and National Fire Protection Association (NFPA), section 86 of 1990.</i></p>
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	<p><i>Danger!</i></p> <p><i>Only fully-trained and qualified personnel should setup and maintain this equipment. Improper setup and operation of this equipment could cause an explosion that may result in equipment damage, personal injury or possible death.</i></p>
---	--

The information in this document is not intended to cover all possible conditions and situations that might occur. The end user must exercise caution and common sense when installing or maintaining Despatch Industries products. If any questions or problems arise, call Despatch Industries at 1-888-DESPATCH or 1-952-469-5424.

	<p><i>Modbus communication protocols require the Protocol 3 controller be updated to version 2.3 or higher.</i></p>
---	--

1.2. **Manufacturer & Service**

Despatch has specialized in thermal processing for over 100 years. Technical expertise gained over those years helps provide innovative solutions to critical applications in vertical markets and cutting edge technology worldwide. Despatch products are backed by a drive for long-term customer satisfaction and a strong sense of responsibility. The worldwide network of factory-trained Service Professionals is available to support your Despatch equipment. From full service preventive maintenance to routine repair and certified calibration and uniformity, the Despatch service network is positioned to respond to your business needs. Our service programs are customized to meet your specific needs using our Advantage Service Assurance Program (ASAP). For more information on ASAP, visit www.despatch.com.


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1.3. Organization of this Manual

This owner's manual contains the most comprehensive set of information for the Despatch Protocol 3™ controller, including installation instructions, theory of operation, operating instructions, among other things.

	<p><i>Danger!</i></p> <p><i>Failure to heed warnings in this instruction manual and on the oven could result in personal injury, property damage or death.</i></p>
---	---

1.4. Conventions

	<p><i>This icon signifies information that describes an unsafe condition that may result in death, serious injury, or damage to the equipment.</i></p>
Danger!	<p><i>Danger is the signal word used to indicate a hazardous situation that, if not avoided, will result in death or severe injury.</i></p>
Warning!	<p><i>Warning is the signal word used to indicate a hazardous situation that, if not avoided, could result in death or severe injury.</i></p>
Caution!	<p><i>Caution is the signal word used to indicate a hazardous situation that, if not avoided, could result in moderate or minor injury.</i></p>
Notice	<p><i>Notice is the signal word used to indicate a hazardous situation that, if not avoided, could result in property damage.</i></p>
	<p><i>This icon signifies supplemental important information.</i></p>
LOG OUT	<p><i>Bold, 10 point sans-serif typeface indicates a specific key or button on screen to click.</i></p>

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1.5. Specifications

Specifications for the Protocol 3 controller include six sets of information:

- Process Input (Table 1)
- Outputs (Table 2)
- Operating Conditions (Table 3)
- Conformance Norms (Table 4)
- Display (Table 5)
- Data Recorder (Table 6)

Table 1. Process Input.

Item	Description																																				
Sampling Rate:	4 per second																																				
Resolution:	16 bits. Always four times better than display resolution.																																				
Impedance:	>10M Ω resistive, except DC mA (5 Ω) and V (47k Ω)																																				
Temp Stability:	Error <0.01% of span per °C change in ambient temperature																																				
Supply Variation:	Supply voltage influence negligible within supply limits																																				
Humidity Influence:	Negligible if non-condensing																																				
Process Display:	Displays up to 5% over and 5% under span limits																																				
Process Variable Input Offset:	Reading adjustable \pm Controller Span. Values added to Process Variable, Values subtracted from Process Variable.																																				
Sensor Break Detection:	<ul style="list-style-type: none"> • Thermocouple & RTD—SSR output goes to 0 • High Limit Sensor Break alarms activate • Linear (4 to 20mA, 2 to 10V and 1 to 5V only)—SSR output goes to 0 																																				
Isolation:	Isolated from all outputs (except SSR driver) at 240V AC																																				
Supported Thermocouple Types & Ranges:	<table border="1"> <thead> <tr> <th>Type</th> <th>Range °C</th> <th>Range °F</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>+100 to 1824°C</td> <td>+211 to 3315°F</td> </tr> <tr> <td>C</td> <td>0 to 2320°C</td> <td>32 to 4208°F</td> </tr> <tr> <td>D</td> <td>0 to 2315°C</td> <td>32 to 4199°F</td> </tr> <tr> <td>E</td> <td>-240 to 1000°C</td> <td>-400 to 1832°F</td> </tr> <tr> <td>J</td> <td>-200 to 1200°C</td> <td>-328 to 2192°F *</td> </tr> <tr> <td>K</td> <td>-200 to 1200°C</td> <td>-328 to 2192°F *</td> </tr> <tr> <td>L</td> <td>0 to 762°C</td> <td>32 to 1402°F *</td> </tr> <tr> <td>N</td> <td>0 to 1399°C</td> <td>32 to 2551°F *</td> </tr> <tr> <td>PtRh</td> <td>0 to 1850°C</td> <td>32 to 3362°F</td> </tr> <tr> <td>20%: 40%</td> <td></td> <td></td> </tr> <tr> <td>R</td> <td>0 to 1759°C</td> <td>32 to 3198°F</td> </tr> </tbody> </table>	Type	Range °C	Range °F	B	+100 to 1824°C	+211 to 3315°F	C	0 to 2320°C	32 to 4208°F	D	0 to 2315°C	32 to 4199°F	E	-240 to 1000°C	-400 to 1832°F	J	-200 to 1200°C	-328 to 2192°F *	K	-200 to 1200°C	-328 to 2192°F *	L	0 to 762°C	32 to 1402°F *	N	0 to 1399°C	32 to 2551°F *	PtRh	0 to 1850°C	32 to 3362°F	20%: 40%			R	0 to 1759°C	32 to 3198°F
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Item	Description		
	S	0 to 1762°C	32 to 3204°F
	T	-240 to 400°C	-400 to 752°F *
	Optional decimal place can be displayed up to 999.9°C/F		
Thermocouple Calibration:	±0.1% of full range, ±1LSD (±1°C for internal CJC if enabled). Linearization better than better ±0.2°C (±0.05 typical) on ranges marked * in the table above. Linearization for other ranges is better than ±0.5°C. BS4937, NBS125 & IEC584.		
Supported RTD Types & Ranges:	Type	Range °C	Range °F
	3-Wire PT100	-199 to 800°C	-328 to 1472°F
	NI120	-80 to 240°C	-112 to 464°F
	Optional decimal place can be displayed up to 999.9°C/F		
RTD Calibration:	0.1% of full range, ±1LSD		
Linearization:	Linearization better than ±0.2°C (±0.05 typical). PT100 input to BS1904 & DIN43760 (0.00385Ω/Ω/°C).		
RTD Excitation:	Sensor current 150µA ±10%		
Lead Resistance:	<0.5% of span error for max 50Ωper lead, balanced		
Supported Linear Types & Ranges:	Type	Range	Offset Range
	mA DC	0 to 20mA DC	4 to 20mA DC
	mV DC	0 to 50mV DC	10 to 50mV DC
	V DC	0 to 5V DC	1 to 5V DC
	V DC	0 to 10V DC	2 to 10V DC
	Scalable from -9999 to 10000. Decimal point selectable from 0 to 3 places, but limited to 5 display digits (e.g. 9999.9)		
Maximum Overload:	1A on mA input terminals, 30V on voltage input terminals		
DC Calibration:	±0.1% of full range, ±1LSD		
DC Input Multi-Point Linearization:	Up to 15 scaling values can be defined anywhere between 0.1 and 100% of input		

Table 2. Outputs.

Item	Description
Relays	
Type & Rating:	Single pole single throw (SPST); 2A resistive at 120/240VAC
Lifetime:	>200,000 operations at rated voltage/current
Isolation:	Basic Isolation

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Item	Description
Linear DC	
Resolution:	8 bits in 250mS (10 bits in 1s typical, >10 bits in >1s typical)
Accuracy:	±0.25% of range, (mA @ 250W, V @ 2kW). Degrades linearly to ±0.5% for increasing burden (to specification limits)
Isolation:	Basic Isolation

Table 3. Operating Conditions (For indoor use).

Item	Description
Temperature:	<ul style="list-style-type: none"> Operating: 0°C to 55°C (32°F to 131°F) Storage: -20°C to 80°C (-4°F to 176°F)
Relative Humidity:	20% to 95% non-condensing
Supply Voltage and Power:	100 to 240VAC ±10%, 50/60Hz, 20VA

Table 4. Conformance Norms.

Item	Description
EMI:	CE: Complies with EN61326
Safety Considerations:	CE: Complies with EN61010-1. UL, cUL to UL61010C-1. Pollution Degree 2, Installation Category II
Front Panel Sealing:	IP65 rating. IP20 behind the panel. (IP rating not recognized / approved by UL)
Front Panel Cleaning:	Wash with warm soapy water and dry immediately. Close the USB cover (if fitted) before cleaning.

Table 5. Display.

Item	Description
Display Type:	160 x 80 pixel, monochrome graphic LCD with a dual color (red/green) backlight
Display Area:	66.54mm (W) x 37.42mm (H)
Display Characters:	0 to 9, a to z, A to Z, plus () - and _

Table 6. Data Recorder.

Item	Description
Recording Memory:	1Mb non-volatile flash memory. Data retained when power is turned off
Recording Interval:	1; 2; 5; 10; 15; 30 seconds or 1; 2; 5; 10; 15; 30 minutes
Recording Capacity:	Dependent on sample rate and number of values recorded. Two values can be recorded for up to 7 days at 10s intervals. More values or faster sample rates deduce the maximum duration.
RTC Battery Type:	VARTA CR 1616 3V Lithium. Clock runs for >1 year without power (Part # 274030)
RTC accuracy:	Real Time Clock error <1 second per day

2. Safety

2.1. Safety Information

Do not work on the Protocol 3 controller without reading and understanding this section which contains important information and warnings. Ignoring these warnings can result in death, serious injury or damage to the machine and product.

2.1.1. Lockout

Machine lockout places the Protocol 3 controller into a zero energy state and prevents accidental machine start up. Always follow the Lockout Procedure described in this Section before cleaning, maintaining or repairing the Protocol 3 controller. An accidental start-up, while working on the Protocol 3 controller, can result in serious injury or death.

2.1.1.1. Lockout Requirements

1. Every power source that can energize any element of the Protocol 3 controller must be shut off at the closest possible power source. This includes air, water, nitrogen and electricity, including the Disconnect Switch.
2. After energy sources are locked out, test to ensure circuits are de-energized.


2.1.1.2. Lockout Procedure with Despatch Products

Personnel authorized to lockout equipment must have the necessary locks to perform the lockout.

1. Physically disconnect all electrical power to the machine or lockout (with a padlock) the appropriate breaker or disconnects.
2. Close all valves and bleed off any pressure.
3. Test for power by attempting a start with the machine controls.
4. Identify the Lockout Condition with a tag on the electrical disconnect and pneumatic shut off valves.
5. When work is complete, remove all tags and restore the machine to its working state.


2.2. Maintenance

Only qualified and trained personnel should perform maintenance or repair.

	<p><i>Danger!</i></p> <p><i>Electrical panels contain high voltage. Disconnect and lock out the power supply before working inside any electrical panels. Failure to lock out the power supply will result in death or injury.</i></p>
---	--

2.3. **Electrical Power**

Only qualified and trained personnel should perform electrical maintenance or electrical repair.


	<p>Danger!</p> <p><i>Contact with energized electrical sources will result in serious injury or death.</i></p>
---	---

- Before performing maintenance, disconnect all electrical power from the machine. Use a padlock and lockout all disconnects feeding power to the machine.
- Never clean or repair the controller when in operation.
- Unauthorized alterations or modifications to Protocol 3 controller are strictly forbidden. Never modify any electrical circuits. Unauthorized modifications can impair the function and safety of the Protocol 3 controller.

2.4. **Fire**

Keep the Protocol 3 controller clean and free of scrap materials, oil or solvents to prevent the possibility of fire. In the event of fire, use a fire extinguisher as follows.

1. De-energize the machine immediately by pushing an Emergency Stop push button (if supplied).
2. Turn off the remote main disconnect (customer supplied disconnect).
3. If the fire is in the workspace, keep the door closed.
4. Extinguish the fire.

	<p>Danger!</p> <p><i>Always disconnect all power before extinguishing a fire. Attempting to extinguish a fire in a machine connected to electrical power will result in serious injury or death.</i></p>
---	---

2.5. **Equipment Lockout Requirements**

To prevent injury or equipment damage during inspection or repair, the Protocol 3 controller must be locked out.

3. Theory of Operation

The Protocol 3 is a microprocessor based digital temperature controller designed for simple and flexible oven operation (Figure 1). The Protocol 3 controller operates as a dual-functioning controller/high limit instrument. The control portion utilizes a time-proportioning voltage signal to control heating devices with minimal temperature fluctuations.



Figure 1. Operator Interface.

The high limit portion protects the product and/or the oven from overheating. If the product being processed has a critical high temperature limit, the high limit setpoint should be set to a temperature somewhat below the temperature at which the product could be damaged. If the product does not have a critical high temperature limit, the high limit setpoint should be set 5 to 15 degrees higher than the maximum programmed setpoint at which the oven will operate.

The Protocol 3 controller provides three primary operating modes:

- **Manual:** Oven operates continuously at a fixed temperature until turned off.
- **Timer:** Oven operates at a fixed temperature for a user-selected time period, and then automatically turns off.
- **Profile:** Temperatures increase or decrease as defined by 255 segments that can be allocated to 64 ramp and soak profiles. The profiles can be linked to provide additional temperature combinations.


The Protocol 3 controlled is equipped to allow a ramp/soak temperature control, which maintains oven temperature with either a fixed setpoint or a ramp/soak profile.

3.1. System Control—In General

- The Protocol 3 controller provides outputs for the cooling fan, door lock switch/door release pushbutton, and optional beacon light
- A number of profiles for oven heating cycles are stored in the Protocol 3 controller. Access profiles using the Protocol 3 keypad
- The Protocol 3 controls the solenoid valves in an inert atmosphere oven for purge, maintain and water cooling operation
- The Protocol 3 can also be operated remotely with a PC running Protocol Manager software.

3.1.1. High-Limit Function

The Protocol 3 controller has an integrated high limit function which disables the heater output when tripped. The High-Limit temperature is displayed as HLPV (Manual Mode only).

If the high limit trips, the Hi-Limit indicator will light and the relay must be manually reset. Allow the oven to cool several degrees below the setpoint (or increase the high limit setpoint) and then press . The indicator will turn off.

3.1.2. Outputs

The Protocol 3 controller comes standard with an output signal that can transmit temperature data, setpoint data or control power to a user-supplied recording device. Output relays (five) can also signal user-specified events or alarm to external devices (Figure 2 and Figure 3).


- **Heating output:** The control output is a DC voltage open-collector output which is time-proportioned and designed to control a heat control device such as a solid state relay.
- **High limit:** The high limit output is a SPDT relay which is energized under normal operating conditions. If the control senses a temperature higher than the high limit setpoint, or if there is a sensor error, the high limit relay will de-energize until the condition is cleared and **Reset** is pressed. When the high limit relay is de-energized, the heater is disabled.
- **Retransmission:** The retransmission output is a signal that is proportional to the process temperature, setpoint or control power:
 - 0-5V
 - 0-10V
 - 2-10V
 - 0-20 ma
 - 4-20 ma
 - 0-10VDC Power Supply

The signal can be an input to other devices such as a chart recorder.

- **Relays:** The five SPST dry contact relay outputs can be configured to function as alarms, events, or end of cycle. These outputs can be utilized in Manual, Timer or Profile Modes.

3.2. Remote Communication

When used with a PC running Protocol Manager™ software, the Protocol 3 controller allows an operator to remotely control the oven, download recipes and log data.




PRL: **BT** **MADE IN UK**


D.O.M: **0711**


MODEL: VE65L41E5

SERIAL No :123456 001 026



VE65L41E5123456001026BT





MODEL: VE65L41E5

SERIAL No: 123456 001 026

ALL RELAY CONTACTS 2A RESISTIVE 120-240VAC

MADE IN UK

D.O.M: 0711 PRL: **BT**

USE COPPER CONDUCTORS (EXCEPT ON T/C INPUT)

AC POWER	RELAY1	RELAY2	RELAY3	RELAY4	RELAY5	Linear Output	PROC INPUT	RS485 Comms	Digital Inputs	SSR Output	HI Limit Output	HI Lim Input
L N G	NO C	NO C	NO C	NO C	NO C	+ -	- mA + + V/mV - + TIC -	- + C	1 2 3 4	+ -	NO COM NC	- mA + + V/mV - + TIC -
1 2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17 18	19 20 21	22 23 24 25	26 27	28 29 30	31 32 33

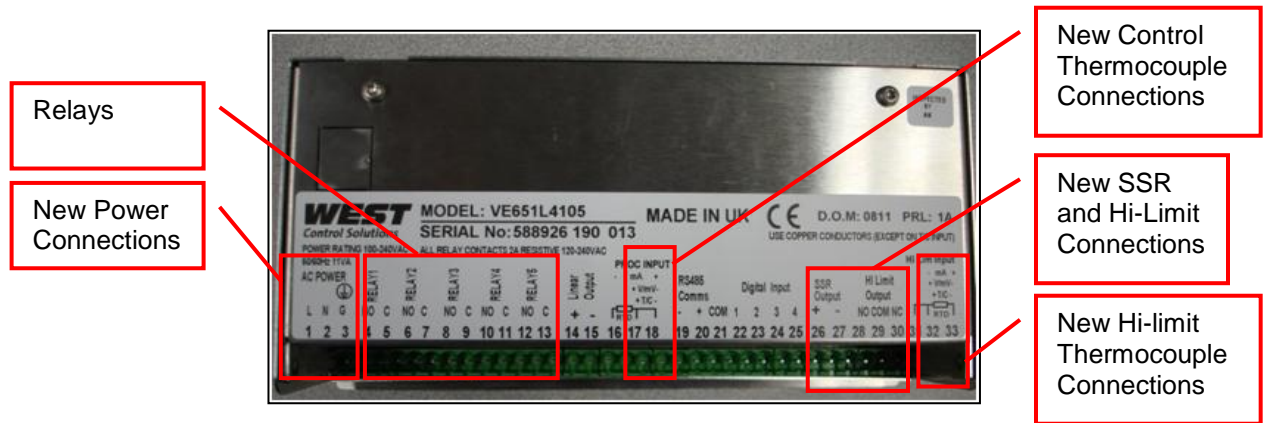
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Figure 2. Typical Controller Output Sticker.



Protocol Plus Rear Panel




Protocol 3 Rear Panel


Figure 3. Protocol Plus to Protocol 3 Connection Conversions.

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4. Assembly & Setup

	<p><i>Danger!</i></p> <p><i>All grounding and safety equipment must be in compliance with applicable codes, ordinances and accepted safe practices.</i></p>
---	--

	<p><i>Warning!</i></p> <p><i>Disconnect the main power switch or power cord before attempting any repair or adjustment.</i></p>
---	--

4.1. Install the Protocol 3 Controller

When replacing a Protocol 3 controller, follow the steps below. Tools required for installation include 1/4" socket set with #1 bit, #2 Philips screwdriver.

1. Disconnect the power.
2. Unplug all terminals on the rear of the control, noting the proper connections (Figure 3).
3. Remove the retaining clips for the controller.
4. Remove the controller.
5. Insert the new controller into the panel.
6. Fasten the retaining clips.
7. Re-plug all terminals.
8. Secure the control panel.

4.2. Protocol 3 Controller Conversion with NO Options

To replace the older model Protocol Plus controller with the newer Protocol 3 controller, connect terminal blocks as indicated in Table 7 and Figure 3.

Table 7. Protocol Plus to Protocol 3 Controller Conversion.

Terminal Block	Former Protocol Plus Connections	New Protocol 3 Connections
Three pin terminal block for power leads	Terminals 30, 31, 32	Terminals 1, 2, 3
Five pin terminal block for SSR and Hi-limit	Terminals 17, 18, 19, 20, 21	Terminals 26, 27, 28, 29, 30
Remove the four-pin terminal block from thermocouples and rewire with two three-pin blocks.	Control Thermocouple Terminals 13, 14	Control Thermocouple Terminals 17, 18
	Hi-limit Thermocouple Terminals 15, 16	Hi-limit Thermocouple Terminals 32, 33


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4.3. *Setting Up Remote Communication*

Remote communication between the Protocol 3 controller and a PC running the Despatch Protocol Manager software involves providing each controller with a unique address and following the communication protocol procedures. Up to 32 separate controllers can be run from a PC running the Despatch Protocol Manager software. See the Protocol Manager Instruction Manual for the complete set-up procedure.




5. Working with Operating Modes

	<p><i>Users and operators of this controller must comply with operating procedures and training of operating personnel as required by the Occupational Safety and Health Act (OSHA) of 1970, Section 5 and relevant safety standards, and other safety rules and regulations of state and local governments. Refer to the relevant safety standards in OSHA and National Fire Protection Association (NFPA), Section 86 of 1990.</i></p>
---	--

5.1. User Controls

Each Protocol 3 Controller has six keypad switches (Table 8). Use the buttons to navigate user menus, adjust parameter values and control outputs. In configuration screens, a context sensitive scrolling help-text displays user-guides about the function of the keys across the bottom of the screen.

The Protocol 3 Controller has nine LEDs which indicate a variety of instrument functions (Table 9).

When the Protocol 3 Controller is first powered ON, the screen displays Select a Mode (Figure 4). Use  and  to navigate and  to select the highlighted mode.

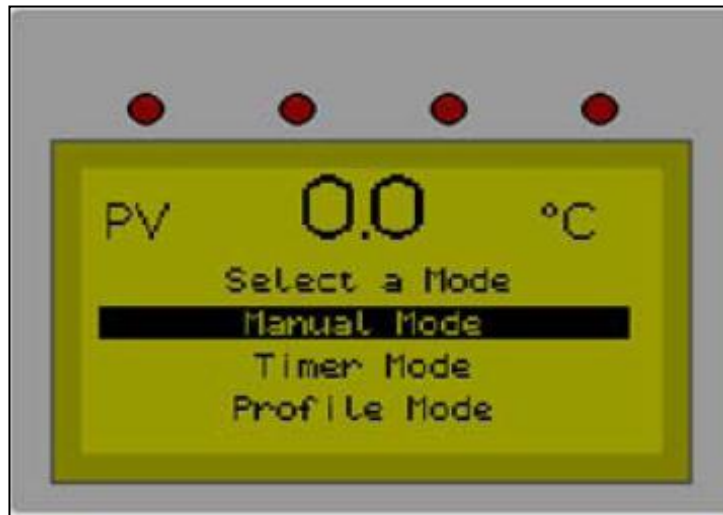


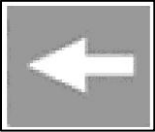








Figure 4. Select a Mode Display.

Table 8. Keypad Buttons and Functions.

Keypad Button	Function

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Keypad Button	Function
	<p>Navigate to previous screen Press to move back to the previous parameter or screen in the current mode.</p>  <p>NOTE: Pressing this switch updates the instrument to the value displayed. If editing a parameter, ensure the current (highlighted) parameter value is correct before pressing.</p>
	<p>Navigate down through menu/parameter lists</p> <ul style="list-style-type: none"> • Menus and configuration choice screens: Press to move to the next item on the list. • Editable values: Press to decrease. Press and hold to speed the change. • Trend View: press to move the Cursor Line back through stored data points.
	<p>Navigate up through menu/parameter lists</p> <ul style="list-style-type: none"> • Menus and configuration choice screens: Press to move to the previous item on the list. • Editable values: Press to increase. Press and hold to speed the change. • Trend View: press to move the Cursor Line forward through stored data points.
	<p>Navigate to next item on a screen or to next screen</p> <ul style="list-style-type: none"> • Press to move forward to the next parameter or screen in the current mode. • Enables Edit on parameters in the Main Mode selections.  <p>NOTE: Pressing this switch updates the instrument to the value displayed. If editing a parameter, ensure the current (highlighted) parameter value is correct before pressing.</p>
	<p>Manual, Timer and Profile Mode: press to stop current process</p> <ul style="list-style-type: none"> • In Manual Mode, pressing switch disables the controlling output • In Timer Mode, pressing switch stops timer and disables controlling output • In Profile Mode, pressing switch stops current profile and disables controlling output
	<p>Reset Latched High Limit relay if below alarm condition If High Limit alarm is active, press to release the High Limit relay.</p>  <p>NOTE: This switch releases the High Limit relay only if the controller is</p>





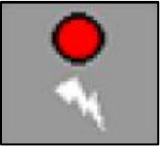









Keypad Button	Function
	not in the High Alarm State (LED indicator turned OFF).
	<p>Simultaneously press  and  to move up one menu level:</p> <ul style="list-style-type: none"> • From Select a Mode, pressing both moves to the main menu. • From Sub-menus, press both several times to reach the main menu. <p style="text-align: center;"></p> <p>NOTE: Simultaneously pressing these switches updates the instrument to the value displayed. If editing a parameter, ensure the current (highlighted) parameter value is correct before pressing.</p>

Table 9. LEDs and Functions.


LED	Function
	Power LED: When lit, indicates power to the device.
	Heater LED: When lit, indicates primary heating output is active.
	Profile LED: When lit, indicates a profile is currently running.
	Timer LED: When lit, indicates a timer is currently running.
	Manual LED: When lit, indicates the controller is in Manual Mode.

LED	Function
	Cycle Complete LED: When lit, indicates the controller is currently stopped.
	When lit during a profile or Timer Mode, indicates process value has deviated from the soak value indicated by the controller. Set Soak Deviation value in the Profile Configuration mode or in the Timer Mode from the Main Menu. See Troubleshooting Section 7 for more information.
	When lit indicates the controller has exceeded the High Limit Value. Set High Limit Alarm Value and Hysteresis in the Alarm Configuration menu.
 (Four LEDs located above LCD display)	When lit, indicates relays 1-4 are active. Relay can be assigned as an Event, Alarm or Cycle.

5.2. First Screens

	<i>Change configuration controls depending on the mode used. Refer to the specific operating instructions below, for more information.</i>
---	---

At initial power-up, control is in **Select a Mode**. This screen allows the choice of manual mode, timer mode or profile mode.

	<i>Regularly backup critical system data according to your company policies. Be sure to back up configuration and profiles to a removable memory device. Refer to Section 5.5.1 for more information.</i>
---	--

5.2.1. Manual Mode

Manual Mode allows the oven to operate continuously at a fixed temperature until turned off. Use Manual Mode (Figure 5) to control Set Point, High Limit Value and four relays.

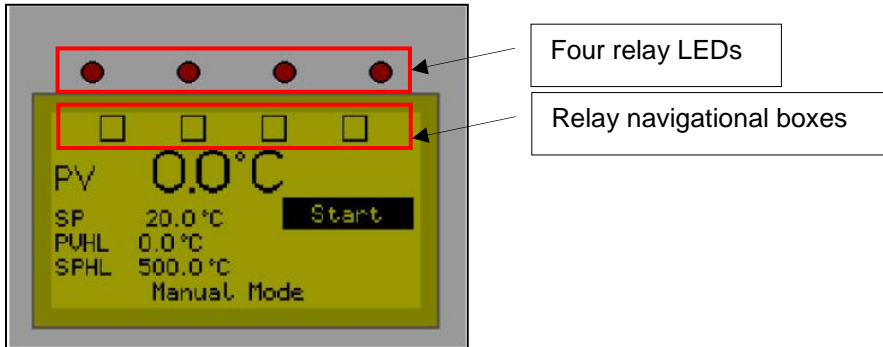














Figure 5. Manual Mode Display Screen.

5.2.1.1. Display Manual Mode

From the **Select a Mode** screen, press or to navigate to **Manual Mode**. Press to select the highlighted option. Press to exit from **Manual Mode** and to stop all outputs.
















5.2.1.2. Start Manual Mode

1. Navigate to and highlight **Manual Mode**.
2. Press to display the **Manual Mode** screen.
3. Manual Mode allows you to set the setpoint (SP), and the High Limit set point (HLSP).
 - a. Press or to navigate through the menu.
 - b. Select and highlight the menu item.
 - c. Press .
 - d. Press or to change values.
 - e. Press to select the value.
4. Manual Mode allows you to set event relay status
 - a. Press or to navigate to and select the appropriate relay (Figure 5).
 - b. Press to toggle the relay on and off.
5. Once all parameters are set, press or to navigate to and highlight **Start**.
6. Press to start the process.
 - a. Press to abort the process.

- b. After pressing , press  to return to **Select a Mode** screen
7. Adjust the temperature setpoint while running in Manual or Timer Mode by:
 - a. Press .
 - b. Press  or  to select mode of operation.
 - c. Press .
 - d. Press  or  to change the SP value.
 - e. Press .
 - f. Press .
8. Return to Stopped Mode at any time, press  and the Cycle Complete LED will illuminate
Press  to select a mode screen.

5.2.2. Timer Mode

Use **Timer Mode** to control Time Set Point: when the time expires, the control output is turned OFF (Figure 6).

1. Navigate to and highlight **Timer Mode**.
2. Press  or  to navigate to the desired time or temperature units.
3. Press  to select the value to change.
4. Press  or  to change value.
5. Press  to enter the desired value.
6. **Timer Mode** allows you to set event relay status:
 - a. Press  or  to navigate to and select the appropriate relay (Figure 5).
 - b. Press  to toggle the relay ON and OFF.
7. Set all parameters then press  or  to navigate to and highlight **Start**.
8. Press  to start the process.
 - a. Press  to abort the process
 - b. Press  to return to Select a Mode screen.
9. Adjust the temperature setpoint while running in **Manual Mode** or **Timer Mode** by:
 - a. Press .

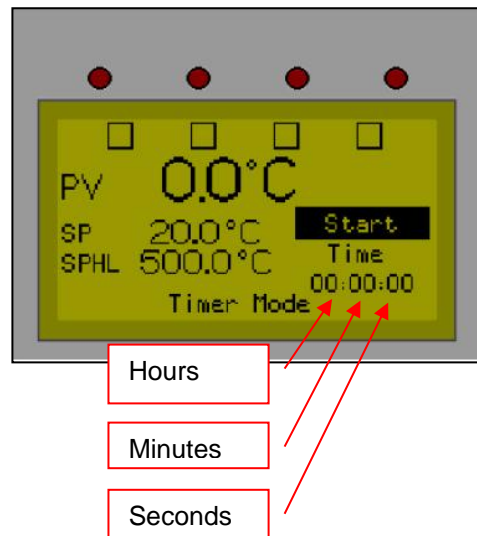















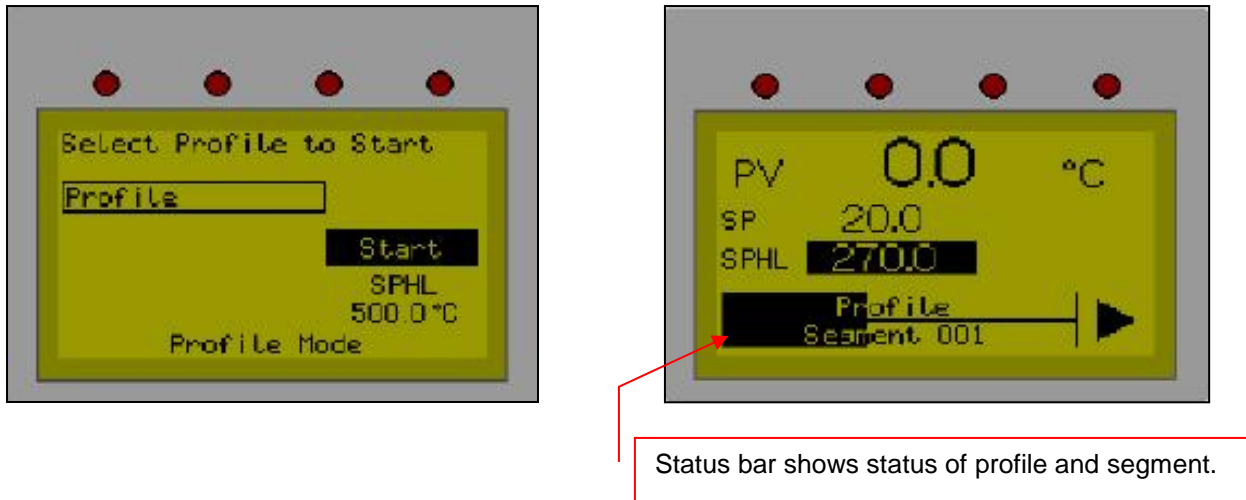



Figure 6. Timer Mode Display Screen.

- b. Press  or  to navigate to the desired time or temperature units.
 - c. Press .
 - d. Press  or  to change the SP value.
 - e. Press .
 - f. Press  to return to normal display.
10. To return to **Stopped Mode** at any time, press  and the Cycle Complete LED will illuminate.
 11. Press  to return to **Select A Mode** screen.

5.2.3. Profile Mode

Navigate to HLSP to set the High Limit Setpoint before running a profile. Use Profile Mode to select and run profiles that are programmed into the unit (Figure 7). Press  or  to navigate,  to select the highlighted profile. Press  to start profile. Press  to stop the profile and  to exit Profile Mode (profile must be stopped to exit Profile Mode).



	<p><i>If you are unable to select a desired profile, verify that Remote Profile Control is Disabled. When Remote Profile Control is Disabled, the Select Profile to Start reads "Digital"</i></p>
--	---

5.2.4. Main Menu

The Main Menu (Figure 8) provides access to a number of useful sub menus (Table 10). Access the Main Menu from the **Select a Mode** screen (Figure 4) by:







1. Simultaneously press  and .
2. Press  or  to navigate,  to select the highlighted option.
3. Press  to enter that mode.




Figure 8. Main Menu.

Table 10. Sub Menu Descriptions

Menu Item	Description
Mode Selection	Return to Select a Mode screen
Timer Mode	See Timer Mode Option (Section 5.2.2)
Profile Setup	Create, edit and delete profiles
Recorder Control	Start, stop and delete recordings on unit.
USB Menu	Access all read/write options to USB device
Configuration Menu	Program all input and output settings
Automatic Tuning	Opens selection for Auto and Self Tune features
Product Information	Display information about unit
Service Information	Display name and address of service department

5.3. Setting up a Profile

	<p>Regularly backup critical system data according to your company policies. Be sure to back up configuration and profiles to a removable memory device. Refer to Section 5.5.1 for more information.</p>
---	--

Use Profile Setup to create, edit and delete profiles (Figure 9). Access the Profile Setup from the Main Menu screen. The Profiler option allows storage of up to 255 profile segments, shared between a maximum of 64 Profiles. Each profile controls the value of the setpoint over time; increasing, decreasing or holding its value as required. See Table 11 for Profile Setup options. Figure 10 (Table 12) shows the Protocol 3 Controller configuration options. Table 13 shows the full list of Profile Parameter options.



Figure 9. Profile Setup.


	<p>Find General Configuration Parameters in Section 5.6. Find Profile Setup in Section 5.3</p> <p>Note that other options are not visible until a profile is created.</p>
---	---

Table 11. Profile Setup Options.

Menu Item	Description
General Configuration	Enable remote Profile control and Profile automatic start
Create a Profile	Create profile
Edit a Profile Header	Change the name of any created profile
Edit a Profile Segment	Change the settings of a specific segment in a profile
Insert a Segment	Create a new segment in an existing profile
Delete a Segment	Delete a segment in an existing profile
Delete a Profile	Delete an existing profile
Delete all Profiles	Delete all profiles in the unit

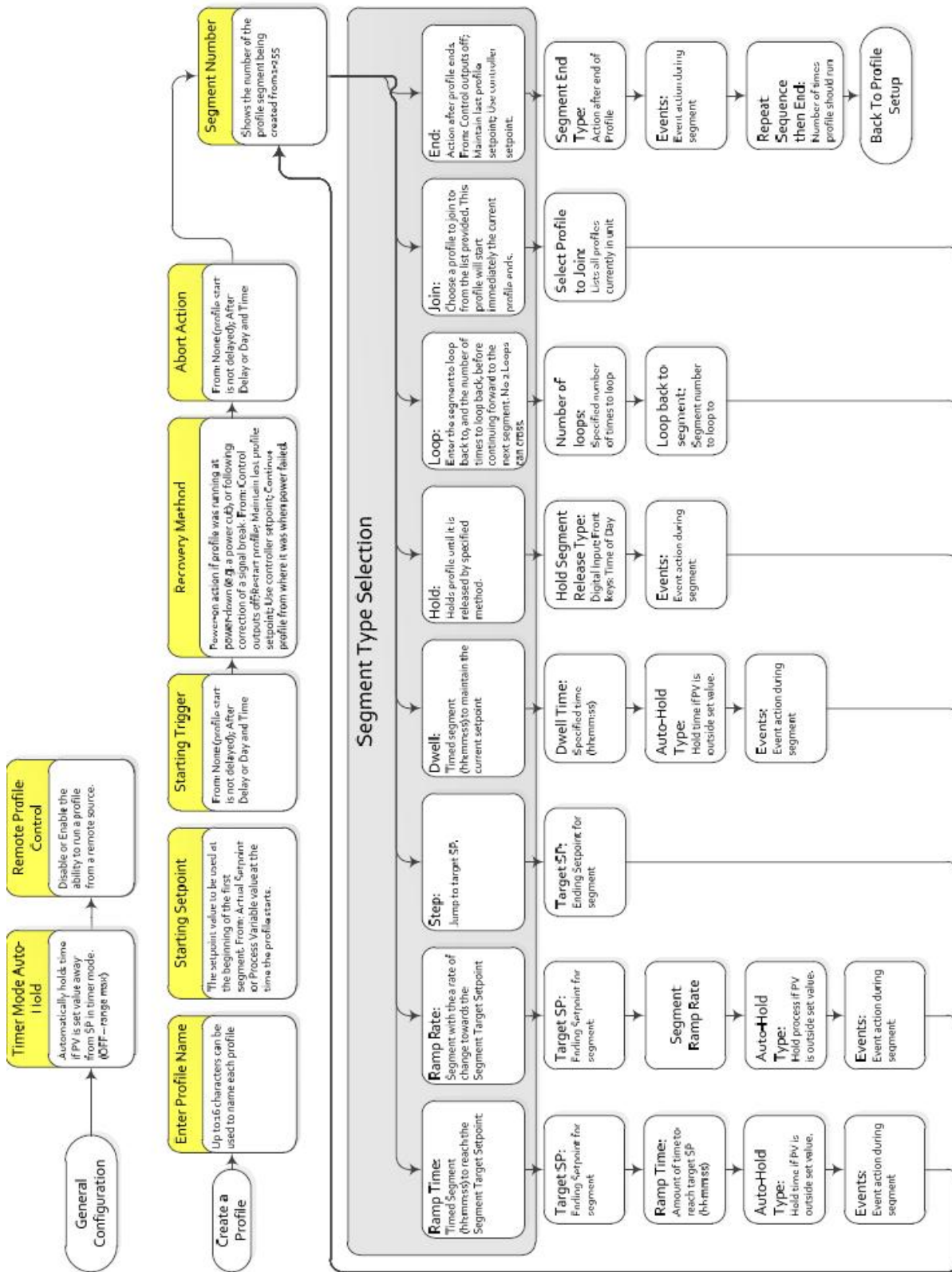
















Figure 10. Profile Setup Menu.

Table 12. Profile Setup Steps, Options and Descriptions.

Step #	Protocol 3 Descriptor	Option	Description
General Configuration			
1.	Remote Profile Control	Disabled	Disallow a remote source to run a profile
		Enabled	Allow a remote source to run a profile
2.	Automatic Start	Disabled	Disallow use of delayed start time
		Enabled	Allow controller to start at a later time with programmed delay
Create a Profile			
3.	Enter a Profile Name		Unique name for each profile using up to 8 characters
4.	Profile Start Trigger	None	Profile start not delayed
		After Delay	Set hours and minutes to delay before starting the profile
		Day and Time	Set time of day (hour and minutes) and day of week to start profile. Options include each day of the week and combinations of days.
5.	Profile Recovery Method		If power-down occurs while this profile is running, specify the action for the controller to take during power-up:
		Control Off	Controller goes to OFF
		Restart Profile	Controller restarts current profile
		Maintain Last Profile SP	Controller maintains previous profile setpoint
6.	Profile Abort Action		If program aborts, profile should:
		Control Off	Controller goes off
		Maintain Last Profile SP	Choose the number of times to cycle the program, up to an infinite number of times.
Edit a Profile Segment			
7.	Edit Segment Number	Ramp Time	<ul style="list-style-type: none"> Set target setpoint (degrees centigrade) Set the segment ramp time (hh:mm:ss) Set the Auto-Hold Type: None, Above Setpoint, Below Setpoint, Band. Set Events 1-5: Press  or  to toggle between Active and Inactive.
8.		Ramp Rate	<ul style="list-style-type: none"> Set the target setpoint (degrees centigrade) Set the segment ramp rate in units per hour Set the Auto-Hold Type: None, Above Setpoint, Below Setpoint, Band. Set Events 1-5: Press  or  to toggle between Active and Inactive.
9.		Step	Set the target setpoint (degrees centigrade)
10.		Dwell	<ul style="list-style-type: none"> Choose time to dwell at setpoint. Specify Auto-Hold type: None, Above setpoint, Below setpoint, Band

Step #	Protocol 3 Descriptor	Option	Description
			<ul style="list-style-type: none"> Set Events 1-5: Press  or  to toggle between Active and Inactive
11.		Hold	<ul style="list-style-type: none"> Choose when to release Hold: Operator Key Press or Time of Day Set Events 1-5: Press  or  to toggle between Active and Inactive
12.		Loop	<ul style="list-style-type: none"> Set the number of times to loop current segment Specify how to move back to the host segment after specified loops: Ramp time, hold Set Events 1-5: Press  or  to toggle between Active and Inactive
13.		Join	<ul style="list-style-type: none"> Joins one profile to another: specified profile immediately follows first profile Navigate to and highlight to select from among the current profiles Set Events 1-5: Press  or  to toggle between Active and Inactive
14.		End	Ends the segment and creates the profile. Choose segment type from: Control Off, Maintain Last Profile SP, Control Off with Events
15.		Repeat Sequence Then End	Repeats sequence specified number of times and then ends the segment and creates the profile. Along with enter numbering of times to repeat sequence, choose from: Control Off, Maintain Last Profile SP, Control Off with Events

5.3.1. Prepare for Profile Setup

From the Select a Mode screen, simultaneously press  and  to display the Main Menu (Figure 8):











1. Navigate to and highlight **Profile Setup**.
2. Press  to display **Profile Setup Enter Profiler Mode Unlock Code** screen.
3. Press  to enter Unlock Code 0010.
4. Press  to display the **Profile Setup** screen.
5. Press  to move right and  to move left. Press  or  navigate through numbers, uppercase letters and lower case letters.
6. After entering the profile name, press  as often as necessary to move to the next screen.

Table 12 will serve as a useful guide for both general configuration and setting up a profile.

	<p><i>Before initiating the Profile Setup, use the programming worksheet (Section 8.3) to work out all parameters. Once the Profile Setup is begun, setup must continue to the end or lose all entered values.</i></p>
---	---

	<p><i>When programming an oven with a gas-fired heater, note that the burner can be started manually or by programming a profile using the Protocol 3 controller.</i></p>
---	--

5.3.2. Sample Profile

Figure 11 shows a graphic representation of the sample profile, while Figure 12 shows the parameters entered to achieve that profile. Section 5.3.3 shows how to enter the profile.

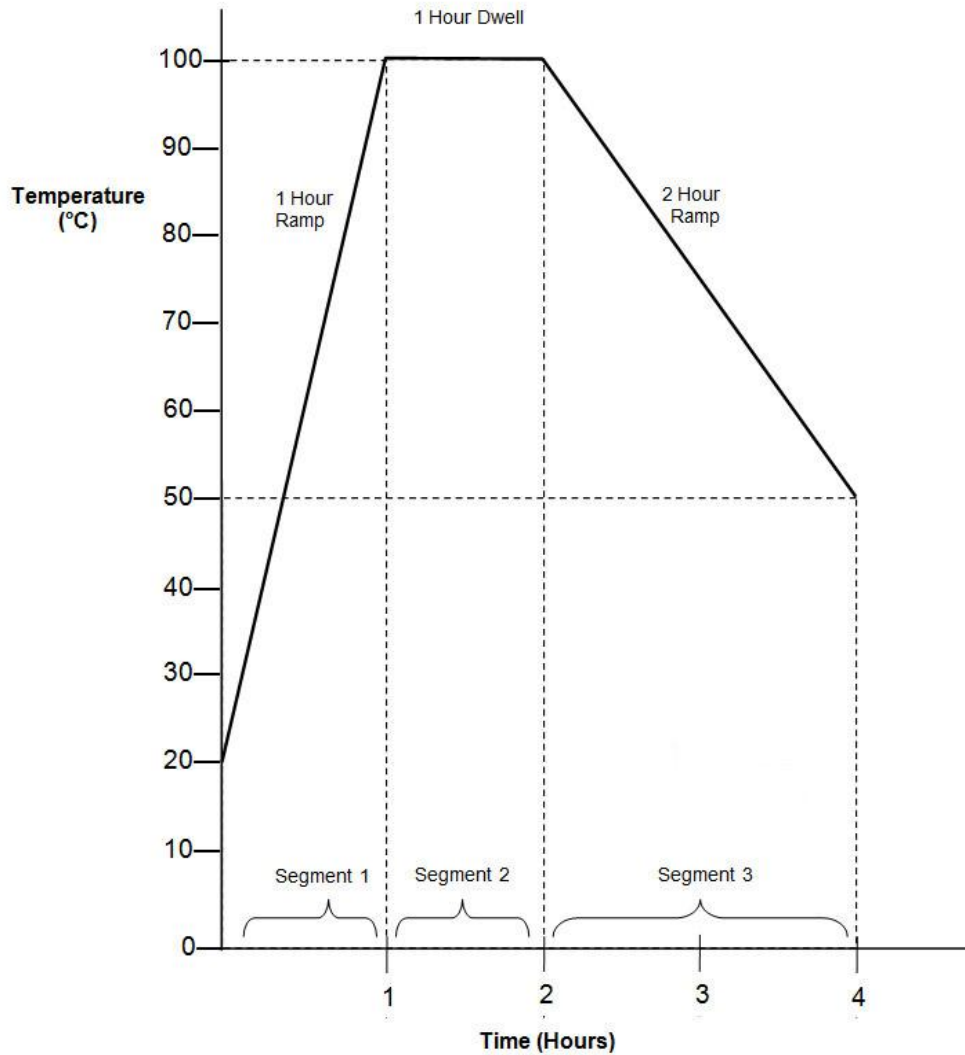


Figure 11. Sample Profile.



Profile Name: 1									
Profile Number: <i>Profile 001</i>									
Segment	Segment Type	Target Setpoint	Time	Auto Hold Type	Events				
					1	2	3	4	5
1	<i>Ramp Time</i>	100	01:00:00	<i>None</i>					
2	<i>Dwell</i>		01:00:00	<i>None</i>					
3	<i>Ramp Time</i>	50	02:00:00	<i>None</i>					
4	<i>End</i>								

















Figure 12. Sample Profile Values.

5.3.3. Key In the Sample Profile Setup








To help show the process of setting up a profile, this section uses the sample profile as an example (from Figure 11 and Figure 12). Figure 10 shows the overall flowchart for working with Profile Setup. For entering sample values, we choose the default values.




Navigate to and Enter Profile Setup

From Select a Mode screen, simultaneously press  and  to display the Main Menu:








1. Navigate to and highlight **Profile Setup**.
2. Press  to display **Profile Setup Enter Profiler Mode Unlock Code** screen.
3. Press  to enter Factory Unlock Code 0010.
4. Press  to display the **Profile Setup** screen.
5. Press  to select **Create a Profile**.
6. Press  to enter mode.
7. Input unique Profile name: press  to move right and  to move left. Press  or  to navigate through numbers, uppercase letters and lower case letters.
8. After entering the profile name, press  as often as necessary to move to the next screen.
9. For **Profile Start Trigger**, when **None** is highlighted, press  to complete the entry.
10. For **Profile Recovery Method**, when **Control Off** is highlighted, press  to complete the entry.
11. For **Profile Abort Action**, when **Control Off** is highlighted, press  to complete the entry.
12. For **How Many Time to Cycle Program**, press  and  navigate to the desired number of cycles.
 - a. Press  to complete the entry.

Program Segment 1 according the Sample Profile (Figure 11 and Figure 12):











13. When **Segment Number 1** displays, press  .
14. Highlight **Ramp Time** and press  .
15. For **Target Setpoint**,
 - a. Press  or  navigate to 100°C (212°F).
 - b. Press  to complete the entry.
16. For **Segment Ramp Time**,
 - a. Press  or  navigate to 1 hour (**01:00:00**).

- b. Press  as needed to complete the entry.
- 17. For **Auto-Hold Type**, when **None** is highlighted, press  to complete the entry.
- 18. For **Event 1-5**, press  as needed to accept **Inactive**.



Program Segment 2 according the Sample Profile:


- 19. When **Segment Number 2** displays, press  .
- 20. Highlight **Dwell** and press  .
- 21. For **Dwell at 100.0°C (212 °F)**,
 - a. Press  or  navigate to 1 hour (**01:00:00**).
 - b. Press  as needed to complete the entry.
- 22. For **Auto-Hold Type**, when **None** is highlighted, press  to complete the entry.
- 23. For **Event 1-5**, press  as needed to accept **Inactive**.

Program Segment 3 according the Sample Profile:

- 24. When **Segment Number 3** displays, press  .
- 25. Highlight **Ramp Time** and press  .
- 26. For **Target Setpoint**,
 - a. Press  or  navigate to 20°C (68°F).
 - b. Press  to complete the entry.
- 27. For **Segment Ramp Time**,
 - a. Press  or  navigate to 2 hours (**02:00:00**).
 - b. Press  as needed to complete the entry.
- 28. For **Auto-Hold Type**, when **None** is highlighted, press  to complete the entry.
- 29. For **Event 1-5**, press  as needed to accept **Inactive**.

Finish Profile Creation:

- 30. When **Segment Number 4** displays, press  .
- 31. Highlight **End** and press  .

	Note: Last segment must be an End segment to exit Profile Entry Mode.
---	--








- a. For **Segment End Type**, with **Control Off** highlighted, press  .
32. For **Profile Created**, press  .
33. Press  and  to display the **Main Menu**. Press  or  to select Mode Selection and press .

Table 13. Profile Parameter Options.

Profile Parameter	Options
Profile Limits	Number of profiles = 64 maximum. Total number of segments (all programs) = 255 maximum.
Loop Back Segments	1 to 9999 loops back to specified segment.
Profile Cycling	1 to 9999 or Infinite repeats per profile.
Sequence Repeats	1 to 9999 or Infinite repeats of joined profile sequences.
Segment Types	Ramp Up/Down over time, Ramp Rate Up/Down, Step, Dwell, Hold, Join A Profile, End or Repeat Sequence Then End.
Time-base	All times specified in hh:mm:ss (Hours, Minutes & Seconds).
Segment Time	Maximum segment time 99:59:59 hh:mm:ss. Use loop-back for longer segments (e.g. 24:00:00 x 100 loops = 100 days).
Ramp Rate	0.001 to 9999.9 display units per hour.
Hold Segment Release	Release With Key-press, At Time Of Day or via a Digital Input.
Start From Value	1st segment starts from current setpoint or current PV input value.
Delayed Start	After 0 to 99:59 (hh:mm) time delay, or at specified day(s) & time. Note: Enable Automatic Start in the Profile Setup: General Configuration Menu. Delayed start will not operate unless Automatic Start has been enabled.
Profile End Action	Selectable from: Control Off, Maintain Last Profile SP, Control Off with Events . Use Controller Setpoint or Control Outputs Off.
Profile Abort Action	Selectable from: Keep Last Profile Setpoint, Use Controller Setpoint or Control Outputs Off.
Power/signal Loss Recovery Action	Selectable from: Continue Profile, Restart Profile, Keep Last Profile Setpoint, Use Controller Setpoint or Control Outputs Off.
Auto-Hold	Off or Hold if input >Band above and/or below SP for each segment.
Profile Control	Run, Manual Hold/Release, Abort or jump to next segment.
Profile Timing Accuracy	0.02% Basic Profile Timing Accuracy. ± <0.5 second per Loop, End or Join segment.
Segment Events	Events turn on for the duration of the segment. For End Segments, the event state persists until another profile starts, the user exits from profiler mode, or the unit is powered down.

5.4. Recorder Control

Use Recorder Control to start, stop and clear recordings (Figure 13). Access the Recorder Control from the Main Menu.








1. Navigate to and highlight **Recorder Control**.
2. Press  to display **Recorder Control Enter Data Recorder Unlock Code** screen.
3. Press  as necessary to enter Factory Unlock Code 0010.
4. Press  to display the **Start/Stop Data Recording** screen.
5. Press  or  to highlight and press  to **Stop Recording** or **Start Recording**.



Figure 13. Recorder Control.

The Recorder Status screen (Figure 14) displays after selecting an option.

Clear a recording while in Recorder Status screen by pressing  to advance to the **Clear Recordings** screen.

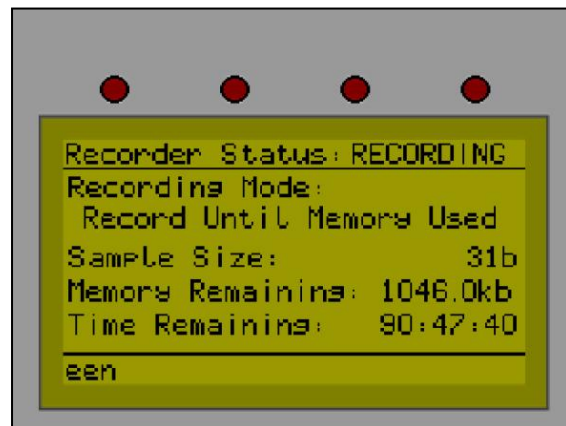



Figure 14. Recorder Status.




All recordings in the unit can be downloaded to a USB device using the USB port and the USB Menu.

5.5. USB Menu

Use **USB Menu** to perform read/write options for USB devices connected to the unit using the front USB port (Figure 15). Access the USB Menu from the **Main Menu**. See Table 14 for USB Menu options.

	<p><i>Regularly backup critical system data according to your company policies. Be sure to back up configuration and profiles to a removable memory device. Refer to Section 5.5.1 for more information.</i></p>
---	--

	<p><i>Note that a memory stick must be in place before the USB Menu will display.</i></p>
---	---

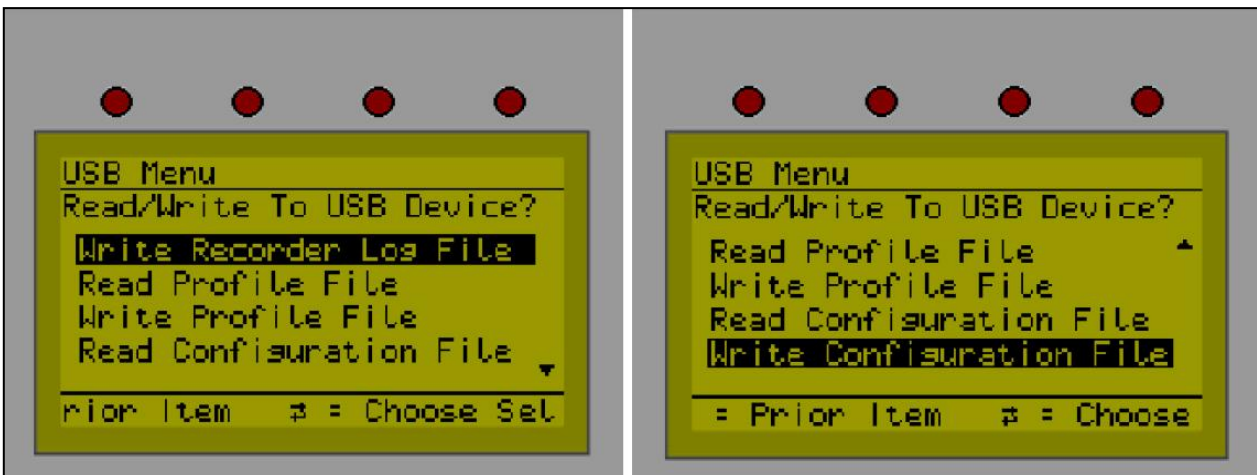





Figure 15. USB Menu.

1. Navigate to and highlight **USB Menu**.
2. Press  to display **Mode Unlock Code** screen.
3. Press  as necessary to enter Factory Unlock Code 0010.
4. Press  to display the **USB Menu** screen.

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Table 14. USB Menu Options.

Menu Item	Description
Write Recorder Log File	Writes recorder Log data to USB
Read Profile File	Read profile from USB device to unit
Write Profile File	Write profile from unit to USB device
Read Configuration File	Read configuration file from USB device to unit
Write Configuration File	Write configuration file from unit to USB device



The Protocol 3 controller continues to control operations when initializing the USB memory stick. Allow time for initializing to complete before beginning new tasks.

5.5.1. Working with USB Memory Stick Folders and Files

Insert a memory stick into the port on the front panel (Figure 16). The Protocol 3 performs an initialization process that finds and/or creates folders on the memory stick (Figure 17):




- **DEVICE:** This folder must be located in the Root of the USB memory stick
- **CONFIG:** Configuration files (*.bct)
- **PROFILE:** Profile program files (*.pfl)
- **RECORDER:** Recorder log folders and files. The user is asked for a new recorder subfolder name before transferring recorder data to USB. The log files (*.csv) are placed in this folder.



Figure 16. USB Port on Front Panel.



Figure 17. USB Files and Folders Requirements (as seen from Windows Explorer).

	<p>Files must be located in these folders to be used by the controller. When preparing to upload files from your PC, ensure that you save them to the correct folder on the memory stick.</p> <p>Note: to speed up the disk operation, keep the number of files stored in these folders to a minimum.</p>
	<p>If the file or folder named already exists, data will be overwritten.</p>
	<p>Do not remove the memory stick from the USB port while a data transfer operation is in progress. Data loss or corruption may result.</p>


5.5.2. File Naming Conventions

The Protocol 3 controller names the first recorder log file **000001-1.csv**. Each time the recording parameters are changed, a new file is created. For instance, changing the recording parameters two times would produce these file names:

- **000002-1.csv**
- **000003-1.csv**








Note that:

- Stopping or starting a recording does not create a new file.
- For any file exceeding 65,500 data lines, the Protocol 3 controller creates a new file with the last digit incremented by 1, for instance: **000001-2.csv**, then **000001-3.csv**.

	<p><i>During Data Transfer, normal operation carries on in the background but operator access to other screens is not possible.</i></p> <p><i>Transfer of full memory can take up to 12 minutes. Begin a transfer only when access (e.g. setpoint changes) will not be required.</i></p>
---	--

5.5.3. Create a New Name Before Writing to the USB Device

Before writing a file (**Write Recorder Log File**, **Write Profile File**, **Write Configuration File**), to the USB device, create a new name for the file or folder.










1. Insert the memory stick into the USB port.
2. For **Enter USB Mode Unlock Code**, press  to reach **0010**.
3. Press  to display the **Read/Write To USB Device?** choices:
 - a. **Write Recorder Log File**
 - b. **Read Profile File**
 - c. **Write Profile File**
 - d. **Read Configuration File**
 - e. **Write Configuration File**
4. For **Write Recorder Log File**, press  to display Enter a Folder Name.
5. Input unique file name: press  to move right and  to move left. Press  or .
6. For **Confirm Write?**,
 - a. Press **No** to abort the process and return to the previous menu
 - b. Press **Yes** to continue to write the file or folder.

5.6. Configuration Menu

Configuration provides access to menus that allow for setting up 11 different options:

1. Input: Input settings and calibrate for process and High Limit Inputs
2. Control
3. Output
4. Alarm
5. Power Fail Recovery
6. Comms. (Communication)
7. Recorder
8. Clock
9. Display
10. Lock Code Configuration
11. Reset to Defaults

Navigate the configuration menus options using the flowchart (Figure 18) or Table 15. Figure 18 shows the Protocol 3 Controller configuration options. Access the Configuration from the Main Menu (Section 5.2.4):

1. Simultaneously press  and .
2. Navigate to **Configuration Menu** using  or .
3. Press  to **Enter Configuration Menu Mode Unlock Code.**
4. Press  to reach **0010**, the Mode Unlock Code.
5. Press  to display the configuration choices.
6. Navigate to the desired option using  and .

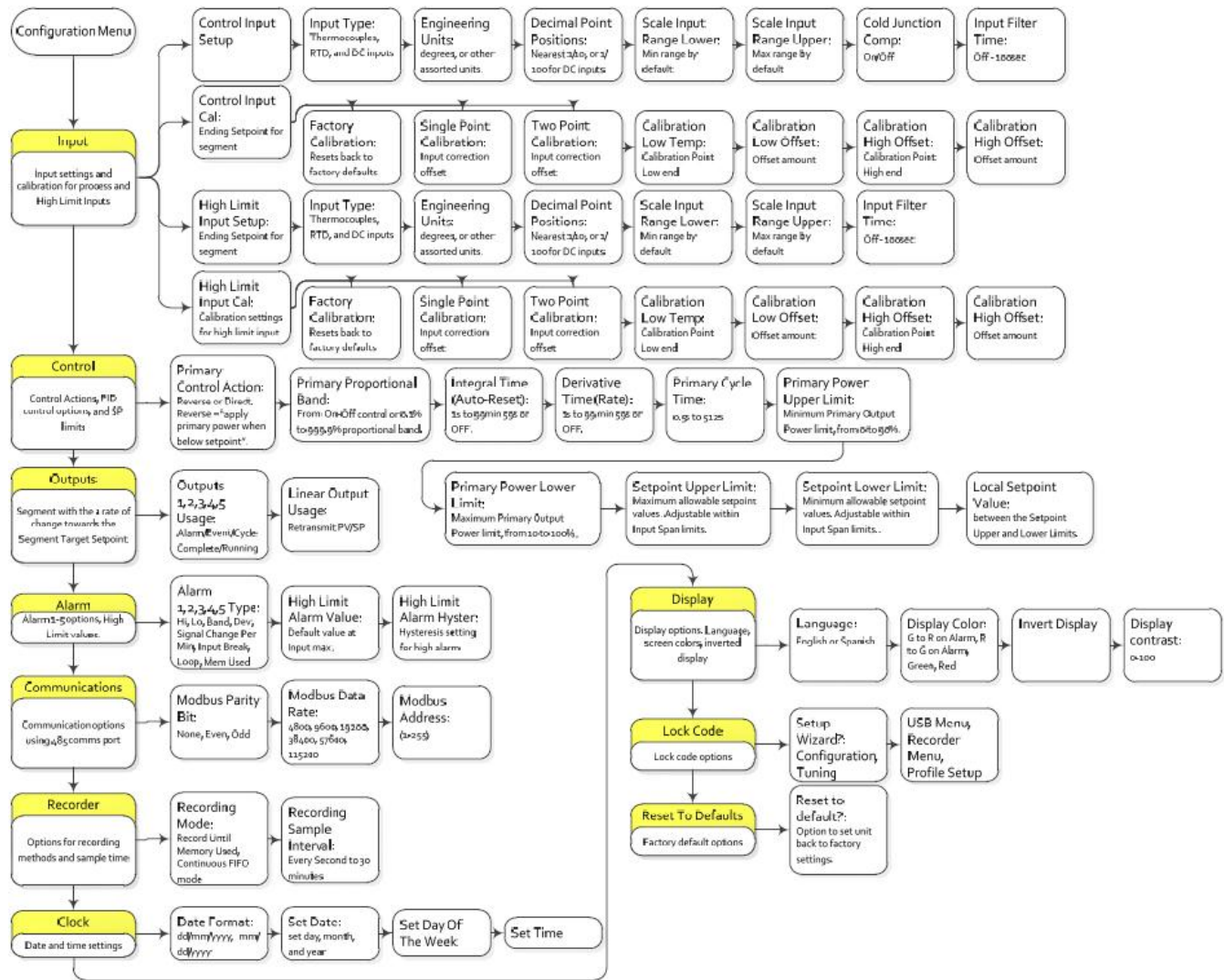


Figure 18. Configuration Menu (see also Table 15 for more information).

Table 15. Configuration Menu in Tabular Format.










Config-uration Menu	Description	Function	Available Settings
Input	Provide primary control and high limit settings	Control Input Setup	<ul style="list-style-type: none"> • Input Type: Thermocouples, PtRh, PT100, NI120, amperages, voltages • Engineering Units: °C, °F, °K, bar, %, %RH, pH, psi or none • Decimal Point Position: Nearest 1/10 or 1/100 for DC inputs • Scale Input Range (lower and upper limits): Min & Max range. Minimum range by default. • Input Filter Time: OFF-100 Sec • Cold Junction Compensation: Disable/Enable
		Control Input Calibration	<ul style="list-style-type: none"> • Factory Calibration: • Single Point Calibration: OFF, -400-+400° • Two Point Calibration: Low Temp. Low Offset, High Temp, High offset
		High Limit Input Setup	<ul style="list-style-type: none"> • Input Type: Thermocouples, PtRh, PT100, NI120, amperages, voltages • Engineering Units: °C, °F, °K, bar, %, %RH, pH, psi or none • Decimal Point Position: Nearest 1/10 or 1/100 for DC inputs • Scale Input Range (lower and upper limits): Min & Max range • Input Filter Time: OFF-100 Sec
		High Limit Input Calibration	<ul style="list-style-type: none"> • High Limit Process Variable: -250 • Factory Calibration: Resets back to factory defaults • Single Point Calibration: OFF, -400-+400° • Two Point Calibration: Low Temp, Low Offset, High Temp, High Offset
Control	Set control actions, PID control options and setpoint limits	Primary Action Control	<ul style="list-style-type: none"> • Reverse Action /Direct Action: Reverse applies primary power when below setpoint • Primary Proportional Band: From ON-Off control or set width of band from 0.1 to 999.9 • Integral Time (Auto-Reset): 1 sec to 99 min 59 sec or OFF • Derivative Time (Rate): 1 sec to 99 min 59 sec or OFF • Primary Cycle Time: 0.5 sec to 512 sec • Primary Power Upper Limit: Minimum primary power from 1 to 99% available power. Value must be higher than the lower limit. • Primary Power Lower Limit: Maximum primary power from 10 to 100% available power. Value must be lower than the upper limit. • Setpoint Upper Limit: Maximum allowed control setpoint • Setpoint Lower Limit: Minimum allowed control setpoint

Configuration Menu	Description	Function	Available Settings
Output	Set rate of change toward Segment Target Setpoint	Output Configuration	<ul style="list-style-type: none"> • Output [1-5] Usage: Set Alarm, Event, Cycle Complete, Running, or combinations • Linear Output Usage: Set the desired type for any Linear Outputs fitted. From: 0-5, 0-10, 1-5, 2-10V & 0-20, 4-20mA or 0-10VDC adjustable Transmitter PSU. Parameters: Unused, Retransmit PV, Retransmit SP, Control Power
Alarm	Set alarm options and high limit values	Alarm Configuration	<ul style="list-style-type: none"> • Alarm [1-5] Usage: Set Alarm parameters: Unused, Process High, Process Low, PV-SP Deviation, Band, Signal Change Per Min, Input Signal Break, Control Loop, % Memory Used. • High Limit Alarm Value: 1-1000 • High Limit Alarm Hysteresis: Deadband on "safe" side of alarm, through which signal must pass before alarm deactivates.
Power Fail Recovery	Set Control Function on Power Failure	Restart Options	<ul style="list-style-type: none"> • Manual Mode Recovery: Control Off, Restart Manual Mode • Timer Recovery Method: Control Off, Restart Timer, Continue Timer
Communications	Modbus Communication Settings	Set Up Communications	<ul style="list-style-type: none"> • Modbus Parity Bit: None, Even, Odd • Modbus Data Rate: 4800, 9600, 19200, 38400, 57600, 115200 • Modbus Address: 1-255
Recorder	Options for recording methods and sample time	Start and stop the Data Recorder	<ul style="list-style-type: none"> • Stop Recording: • Start Recording: • Recorder Status information: [see configuration menu] • Delete Recording:
Clock	Set date and time for internal clock	Clock Configuration	<ul style="list-style-type: none"> • Date format: dd/mm/yyyy or mm/dd/yyyy • Set Date • Set Day of Week (Choose day of week) • Set Time (hh/mm/ss format)
Display	Set options, language, screen color inverted display	Display Configurations	<ul style="list-style-type: none"> • Language: English or [Alternate language chosen at time of order] • Display Color: Green to red on alarm, Red to green on alarm, Green, Red • Invert Display: Standard or negative display image • Display Contrast: 0-100
Lock Code	Set lock code options	Lock Configurations	<ul style="list-style-type: none"> • Configuration: Off, 1-9999 • Tuning: Off, 1-5000 • USB Menu: Off, 1-7000 • Recorder Menu: Off, 1-9999 • Profile Setup: Off, 1-9999
Reset to Defaults	Factor default options	Reset to Factory Configuration	<p>Reset All Parameters to Factor Defaults?</p> <p>All Setting Will be Lost!</p>

5.6.1. Alarm Configuration

5.6.1.1. Access the Configuration Menu

Access the Protocol 3 controller Configuration Menu,(and sub-menus) by first ensuring the controller is in Cycle Complete state (that is, not running), the control must be in its cycle complete state (not running), if it is in that state

1. Press  to stop the control before proceeding.
2. Simultaneously press  and  from **Select a Mode** to access the Main Menu.
3. From the Main Menu, navigate to **Configuration Menu** using  and . Highlight **Configuration Menu** and press .
4. At the **Enter Configuration Mode Unlock Code** prompt, enter the appropriate code using  and .
 - a. The default code is 10.
 - b. Press . To enter **Configuration Menu**.

5.6.1.2. Work with the Alarm Menu

The alarm menu allows you to configure the five customizable alarms along with configuring Hi Limit settings. Table 16 describes the possible alarm settings (see Glossary of Terms for alarm and parameter descriptions).










1. From the **Configuration Menu**, use  and  to scroll to and highlight **Alarm Configuration**, then press  to access the Alarm Configuration Menu.
2. Press  to move forward through the different parameters in the menu,  and  to enter the setting for a parameter,  to move back through the parameters.
3. Press  and  together (simultaneously) to return to the **Configuration Menu**.

Table 16. Protocol 3 Possible Alarm Settings.

Alarm Selection	Parameter 1	Parameter 2	Parameter 3
Process High	Alarm Value (Degrees)	Alarm Hysteresis (Degrees)	Alarm Inhibit










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Alarm Selection	Parameter 1	Parameter 2	Parameter 3
Process Low	Alarm Value (Degrees)	Alarm Hysteresis (Degrees)	Alarm Inhibit
PV-SP Deviation	Alarm Value (Degrees)	Alarm Hysteresis (Degrees)	Alarm Inhibit
Band	Alarm Value (Degrees)	Alarm Hysteresis (Degrees)	Alarm Inhibit
Signal Change Per Min	Alarm Value (Degrees)	Minimum Duration (Seconds)	Alarm Inhibit
Input Signal Break	N/A	N/A	N/A
Control Loop	Loop Alarm Type	Manual Loop Alarm Time (mm:ss) (active only if loop alarm type is manual)	N/A
% Memory Used	Alarm Value (%)	Alarm Inhibit	N/A

5.6.1.3. Using Alarms to Switch Relay Outputs

The Protocol 3 controller allows alarm states to trigger any of the five relay outputs on the controller. Each output can be set to a specific alarm or multiple alarms using the **Or Alarms** and **Alarm and Events** functions. To configure an alarm state to trigger a relay output:

- From **Configuration Menu**, use  and  to scroll to and highlight **Output Configuration** then press  to access the **Output Configuration Menu**.
- Press  to move forward through the different parameters in the menu,  and  to enter the setting for a parameter,  to move back through the different parameters.
- Press  and  together (simultaneously) to return to the **Configuration Menu**.

5.6.1.4. Alarm Application Example

This alarm example configures the Protocol 3 controller for an application with an external alarm horn wired into Relay 1. The horn should sound if the process value temperature drops two degrees below or rises five degrees above the setpoint temperature of 200 degrees.

1. Access the **Configuration Menu** by following the directions in Section 5.6.1.1 Accessing Configuration Menu.

2. From the **Configuration Menu**, navigate to and select **Alarm Configuration**.

3. Navigate and select **Process High** for **Alarm 1 Type** and press .

4. Navigate to change **Alarm 1 Value** to **205** and press .

5. Navigate to change **Alarm 1 Hysteresis** to **0** and press .



6. Navigate to select **Uninhibited** for **Power-up Inhibit Alarm 1?** and press .

7. Navigate and select **Process Low** for **Alarm 2 Type** and press .


8. Navigate to change **Alarm 2 Value** to **198** and press .

9. Navigate to change **Alarm 2 Hysteresis** to **0** and press .



10. Navigate to select **Uninhibited** for **Power-up Inhibit Alarm 2?** and press .

11. Press  and  together to return to the **Configuration Menu**.

12. Navigate to **Output Configuration** and press .

13. Navigate to and select **Or Alarms** for **Output 1 Usage** and press .

14. Navigate to and select **Alarm 1 | 2** for **Output 1 Alarms** to OR and press .

15. Press  and  together to return to the **Configuration Menu**.

5.6.1.5. Glossary of Alarm Terms

Term	Description
Alarm Hysteresis	Alarm hysteresis is the deadband on the safe side of an alarm (that is, the side of the alarm that is below the high alarm value or above the low alarm value). The signal must pass through this deadband before the alarm deactivates.
Alarm Inhibit (Not functional on Firmware 2.3 or lower)	Alarm Inhibit prevents unwanted process or deviation alarm activation at power-up or when the controller setpoint is changed. The alarm activation is inhibited until a safe condition is present. The alarm operates normally from that point on. For example, when the alarm is inhibited, a low alarm will not activate at power-up until the process value first rises above the alarm point than falls back below.
Input Signal Break Alarm	If the signal from the process value input is broken the process value will display OPEN and the alarm will activate.
Loop Alarm	A loop alarm detects faults in the control feedback loop by continuously monitoring process variable response to the control output(s). If one of the five alarms is defined to be a loop alarm, it repeatedly checks if the PID control output is at saturation. If saturation is reached (0% or 100% power for single control type), an internal timer is started. Thereafter, if the output has not caused the process variable to be corrected by a predetermined amount (V) after time (T) has elapsed, the alarm becomes active. Subsequently, the alarm repeatedly checks the process variable and the PID output. When the process variable starts to change value in the correct sense or when the PID output is no longer at the limit, the alarm is deactivated. For PID control, the loop alarm time (T) can be automatic (twice the Integral Time value) or set to a user defined value. Correct operation with the automatic loop alarm time depends upon reasonably accurate PID tuning. The user defined value is always used for On-Off control, and the timer starts as soon as an output turns on. The value of V depends on the input type. For Temperature inputs, V = 2°C or 3°F. For Linear inputs, V = 10 x LSD (Least Significant Digit—smallest incremental value that can be show at the defined display resolution).
% Memory Used Alarm	The Protocol 3 controller can record data at a set interval. If the percentage selected of the memory capacity of the recorded data is exceeded the alarm will activate.
Process Value Alarms	Three types of process alarms are implemented in the Protocol 3: High, Low, Band . If the process variable passes the boundary, the alarm activates as depicted in Figure 19
PV-SP Deviation Alarm	The control subtracts the process value from the setpoint. If the resulting value exceeds the alarm value setting the alarm will activate.
Signal Change Per Min Alarm	An alarm based on the rate of change in the measured process variable. If the PV changes at a rate greater than the alarm level per minute, the alarm will activate. The rate of change must be above the alarm threshold for longer than the Minimum Duration Of Change time, before the alarm will change state. Caution: If the duration is less than this time, the alarm will not activate no matter how fast the rate of rise.

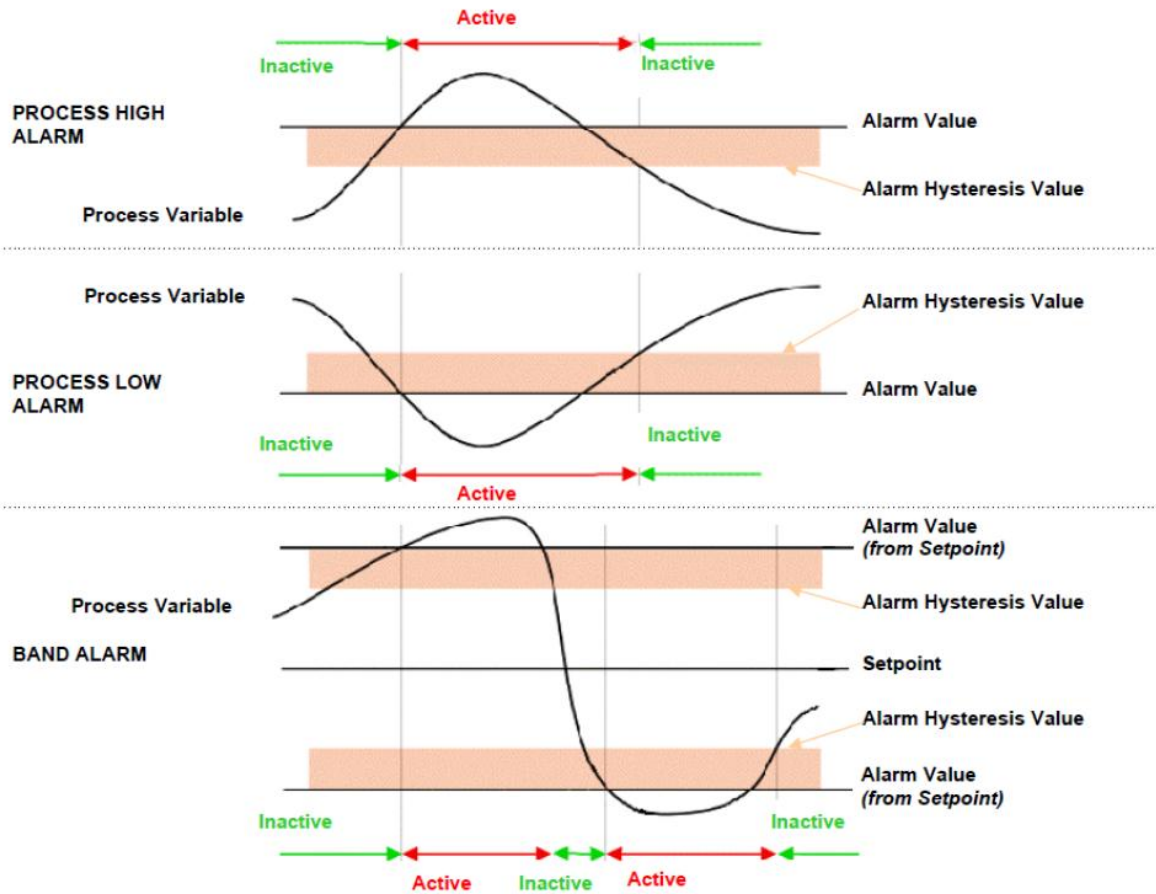


Figure 19. How High, Low and Band process alarms are implemented.

5.6.2. Working with Calibration Offsets







Calibration offsets allow configuration for oven temperature variations. Enter calibration offsets through the **Configuration Menu** and **Input Configuration**.

5.6.2.1. Access the Configuration Menu

To access the **Configuration Menu** and all sub-menus, the controller must be in its Cycle Complete or Stopped state (that is, not running). If the controller is not in the Stopped state, press






to stop the controller before proceeding.

1. Press  and  together from the **Select a Mode** screen to access the Main Menu.
2. From the Main Menu, navigate to and select (highlight) the **Configuration Menu**. Press .
3. A prompt will appear to enter an unlock code. Enter the correct code (the default code is 0010) with  and  then press  to access the **Configuration Menu**.

5.6.2.2. Working with Input Configuration

Input Configuration allows you to configure items associated with the **Control Input Setup**, **Control Input Cal.**, **High Limit Input Setup** and **High Limit Input Cal.** Control calibration offset parameters are located in the **Control Input Cal.**

To work with **Input Configuration**:




1. Navigate from the **Configuration Menu** to and highlight **Input Configuration**. Press .
2. Navigate to and select **Control Input Cal.** Press 
 - a. Three options present: **Factory Calibration**, **Single Point Calibration**, **Two Point Calibration**.
 - b. Only one option can be active at any given time. The highlighted choice becomes the active choice.
3. Navigate to and select the desired choice. Press  to configure the settings within that choice.

5.6.2.3. Factory Calibration

Factory Calibration means there is no calibration offset. Selecting Factory Calibration disables the Single Point Calibration and Two Point Calibration options. There are no settings to configure for Factory Calibration.

5.6.2.4. Single Point Calibration

The Single Point Calibration screen shows the current value by which the process input (PV) is offset. **This offset value will be the maintained throughout the controller's input range.** For example:













1. The controller displayed an oven temperature of 100 degrees with the **Calibration Offset** set to **OFF**.
2. But an independent measurement of oven temperature reveal an actual temperature of 110 degrees inside the oven
3. Use  and  to enter a **Calibration Offset** of 10 degrees. This Calibration Offset increases the displayed temperature by 10 degrees to match the actual temperature measured in the oven.
4. Press .

5.6.2.5. Two Point Calibration

Two Point Calibration provides a way to choose two temperature points with two different offsets. The actual offset at any given temperature will be interpolated between the chosen points and extrapolated above and below the chosen points. For example:

- Given the settings of:
 - Calibration Low Temp = 100 °C
 - Calibration Low Offset = 1 °C
 - Calibration High Temp = 200 °C
 - Calibration High Offset = 2 °C
- The offset at an oven temperature of 0 °C would be 0 °C, the offset at 150 °C would be 1.5 °C, and the offset at 300 °C would be 3 °C.



To set Two Point Calibration:

1. Use  and  to change the value of **Calibration Low Temp**. Press .
2. Use  and  to change the value of **Calibration Low Offset**. Press .
3. Use  and  to change the value of **Calibration High Temp**. Press .
4. Use  and  to change the value of **Calibration High Offset**. Press .

Example of Two Point Calibration:

- With a controller set to Factory Calibration (no offset)
- The display on the control read 100 °C and the actual temperature measured 99 °C.


- If the display on the control read 200 °C and the actual temperature measured was 195°C
- Enter the following settings for Two Point Calibration:
 - Calibration Low Temp = 100, Calibration Low Offset = -1
 - Calibration High Temp = 200, Calibration High Offset = -5

Return to the Main Menu by simultaneously pressing  and .







5.6.3. Setting Up Remote Communication

Remote communication between the Protocol 3 controller and a PC running the Despatch Protocol Manager software involves providing each controller with a unique address and following the communication protocol procedures. Up to 32 separate controllers can be run from a PC running the Despatch Protocol Manager software. See the Protocol Manager Instruction Manual for the complete set-up procedure.

5.7. Automatic Tuning

	<i>Despatch does not recommend the use of Automatic Tuning. In most oven applications, standard configuration has been optimized.</i>
---	--

Access **Automatic Tuning** through the Main Menu (Section 5.2.4). The **Automatic Tuning** menu displays all the auto-tuning options provided in the unit. Table 17 provides additional information of each option.

1. Simultaneously press  and .
2. Navigate to **Automatic Tuning** using .
3. Press  to **Enter Automatic Tuning Mode Unlock Code.**
4. Press  to reach **0010**, the Mode Unlock Code.
5. Press  to step through and accept all automatic tune options.

To manually tune the controller, refer to **Control Configuration** in the **Configuration Menu** (Section 5.6).


Table 17. Automatic Tuning Options.

Menu Item	Description
Pre-Tune	A "single-shot" routine that disengages when complete.
Self-Tune	Continuous tuning routine that must be manually disengaged.

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Auto Pre-Tune	If active, Pre-tune will attempt to run at every power up.
---------------	--

	<p><i>Automatic tuning will not engage if proportional band is set to ON/OFF control.</i></p> <p><i>Pre-tune and Auto Pre-Tune will not engage if the setpoint is ramping or the Process Variable is < 5% of span from setpoint.</i></p>
---	---

5.8. Product Information

Access **Product Information** through the Main Menu (Section 5.2.4). **Product Information** provides detailed information on the unit's software and hardware, such as calibration, firmware and production revision. Table 18 detailed description of the information is provided in the table below.


Press  to step through and accept all product information options.

Table 18. Product Information Details.

Menu Item	Description
Input Calibration Status	Calibration status of mVDC, VDC, mADC, RTD and Thermocouple CJC inputs. All should display as Calibrated
Optional Features	USB Port; Data Recorder (includes USB Port) or Profiler.
Firmware Information	Type and version of firmware.
Product Revision Level	Software and Hardware revision levels
Serial Number Information	Instrument serial number.
Date of Manufacture	Date of manufacture

5.9. Service Information

Access **Service Information** (Figure 20) through the Main Menu (Section 5.2.4). The **Service Information** menu displays contact information for service, sales or technical support.



Figure 20. Service Information Screen.

5.10. Remote Operation

The Protocol 3 controller is equipped for remote operation using the Despatch Protocol Manager software. A PC running Despatch Protocol Manager software can access, operate and log data for up to 32 Protocol 3/Protocol Plus-equipped ovens.

See the Protocol Manager Instruction Manual for complete operation instructions.

5.11. Setting Up Digital Inputs

The Protocol 3 controller can be run by external inputs wired to the controller from an external source such as a PLC or switches on a control panel (Figure 21 displays standard digital input wiring).

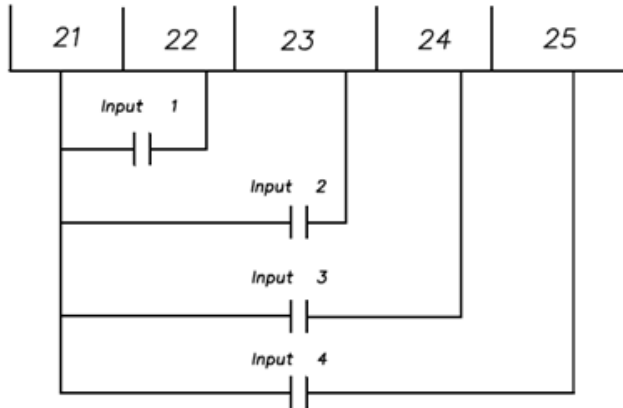



Figure 21. Standard Digital Input Wiring.

Enable Digital Inputs through the **Profile Menu**, then **General Configuration** and set **Remote Profile Control** to **Enable**.

	<p><i>While the Remote Profile Control is enabled, profiles can be run only by digital inputs (versus running profiles from the Profile Mode).</i></p>
---	--

The external run operation can **Run**, **Hold** or **Stop** profiles indexed in positions 1-7 in the memory of the control. Table 19 shows the profile selection.

Table 19. Input settings.

Input 1	Input 2	Input 3	Index Selection
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4

Input 1	Input 2	Input 3	Index Selection
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	7
OFF	OFF	OFF	none

Input 4 controls the action of the selected profile in the following way:

- Switch from OFF to ON to **Start** the selected profile or continue the profile if it is currently in **Hold**.
- Switch from ON to OFF to **Hold** a profile that is running.
- Switch from ON to OFF will **Stop** a profile that is running if Input 1-3 are also OFF.

6. Maintenance

6.1. Replacement Parts

To order or return parts, contact the Despatch Global Service Network. The Service Products features our Response Center for customer service. When returning parts, a Despatch representative will provide you with an RMA (Return Material Authorization) number. Attach the RMA number to the returned part for identification. When ordering parts, expedite your process by providing model number, serial number and part number.

Global Headquarters	Contact	Service & Technical Support
Despatch Industries 8860 207th Street Lakeville, MN 55044 USA	International/Main: 1-952-469-5424 US toll free: 1-888-337-7282 Fax: 1-952-469-4513 info@despatch.com www.despatch.com	Service: 1-952-469-8230 US toll free: 1-800-473-7373 Service @despatch.com

7. Troubleshooting

7.1. Error Messages and Alarm

Table 20 lists the more common error messages, the possible problems and remedies.

Table 20. Error Messages and Next Steps.

Alarm Status	Possible Problem	Next Step
Hi-Limit LED ON	<ul style="list-style-type: none"> Problem with thermocouple Hi-limit setpoint has been exceeded. 	Once the problem has corrected, press Reset .
DEV HOLD LED flashing	Oven temperature has not entered (or dropped out of) the Auto Hold band and the soak timer has stopped	Program a slower ramp rate or if oven is not heating check heater circuit.
Top PV displays OPEN	Control thermocouple is disconnected or broken	Repair or replace the thermocouple.
HLPV displays OPEN	High Limit thermocouple is disconnected or broken	Repair or replace the thermocouple.

7.2. Controller Firmware Revision

Refer to the Protocol 3 Controller Owner's Manual for instructions on how to enter Product Information. Protocol Manager Software requires Version 2.3 or later firmware for the Protocol 3 controller. If the control is version 2.2 or earlier contact Despatch for a replacement.

7.3. Troubleshoot Protocol Manager/Protocol 3 Controller Communication

For problems communicating between the Protocol Manager and Protocol 3 controller, check each controller's communication page for these settings:

- **Address**
 - Assign each controller/oven using an RS422/RS485 interface a unique address.
 - Default = 1
- **Baud Rate**
 - For problems communicating, try a lower baud rate. But start with the default baud rate.
 - Default = 19.2K
- **Parity**
 - Leave parity at the default setting
 - Default = None

In addition to checking for proper settings:

- Check cabling between the computer running the software and the oven (Figure 22)
- Review schematics for older model serial converters (Figure 23)
- Review schematics for newer model serial converters (Figure 24)
- Review schematics for USB converter (Figure 25)

Review the Protocol Manager manual for specific tips and techniques for troubleshooting communication problems

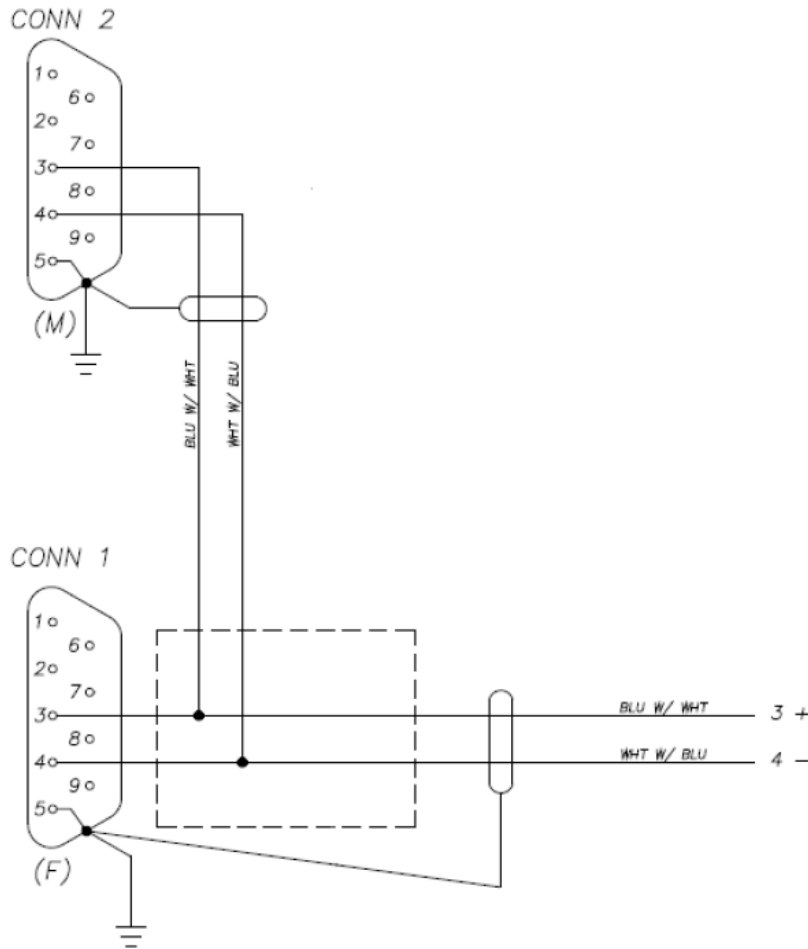


Figure 22. Check Cabling.

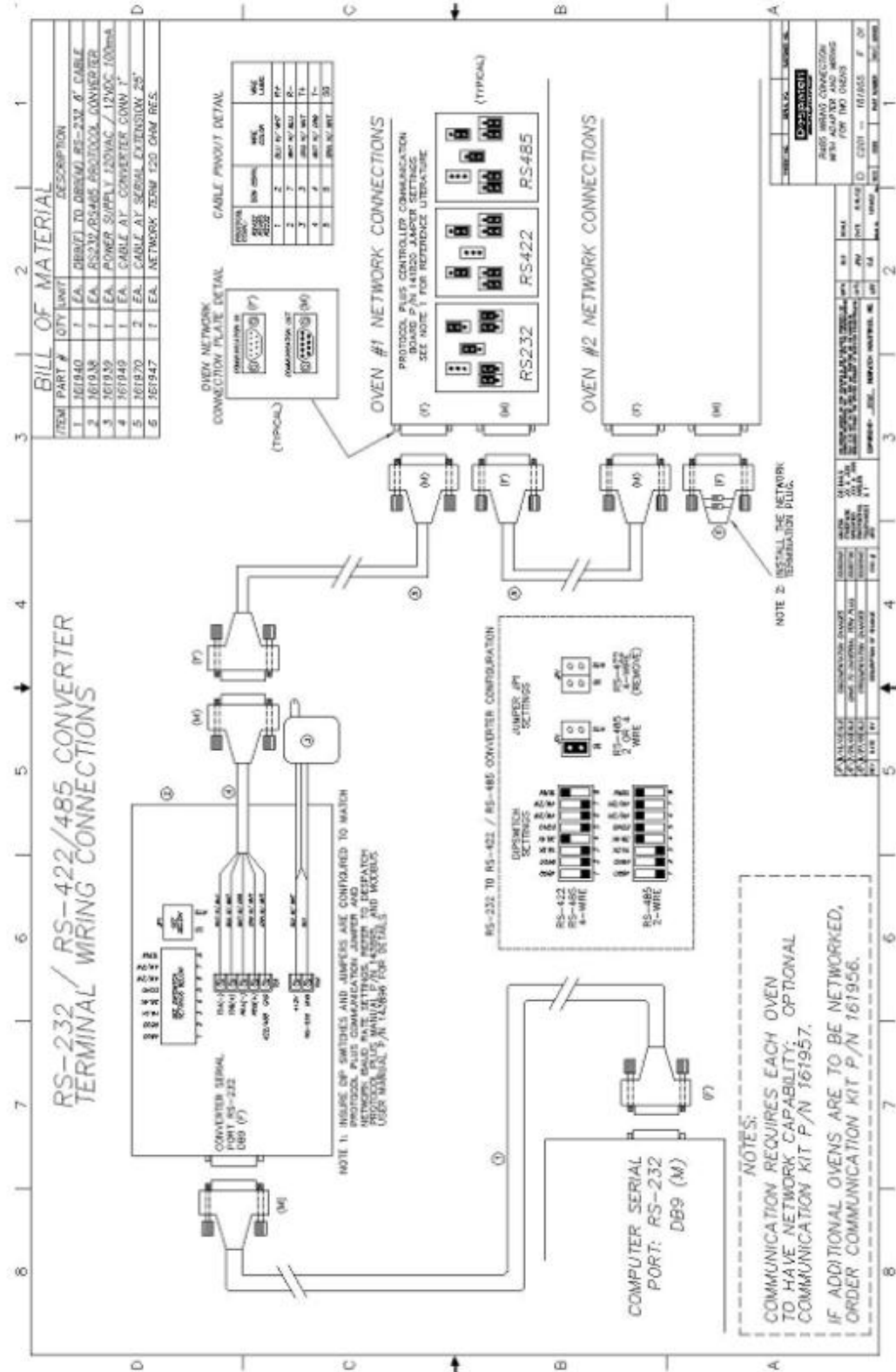


Figure 23. Older model serial converter schematic.

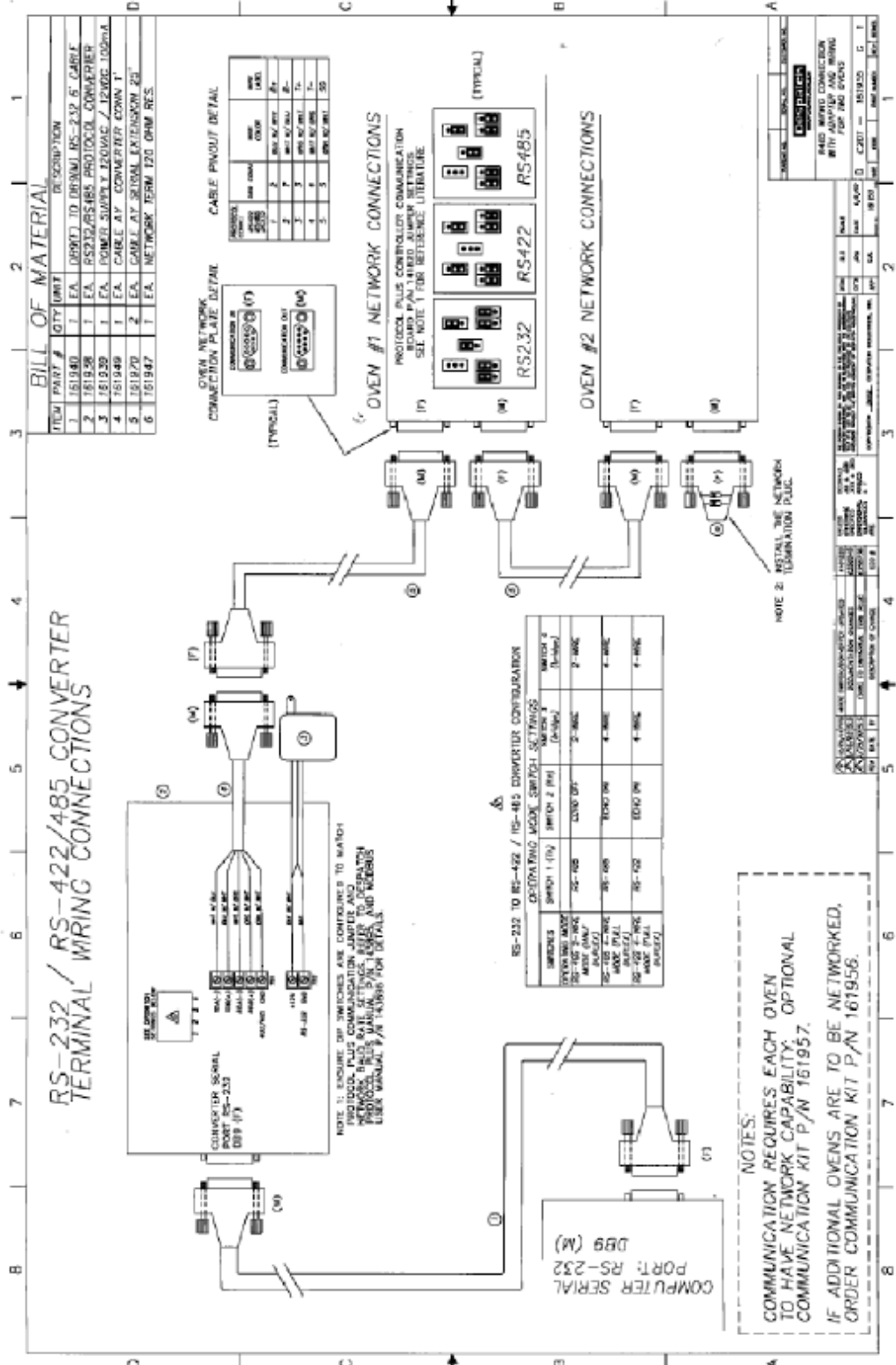


Figure 24. Newer model serial converter schematic.

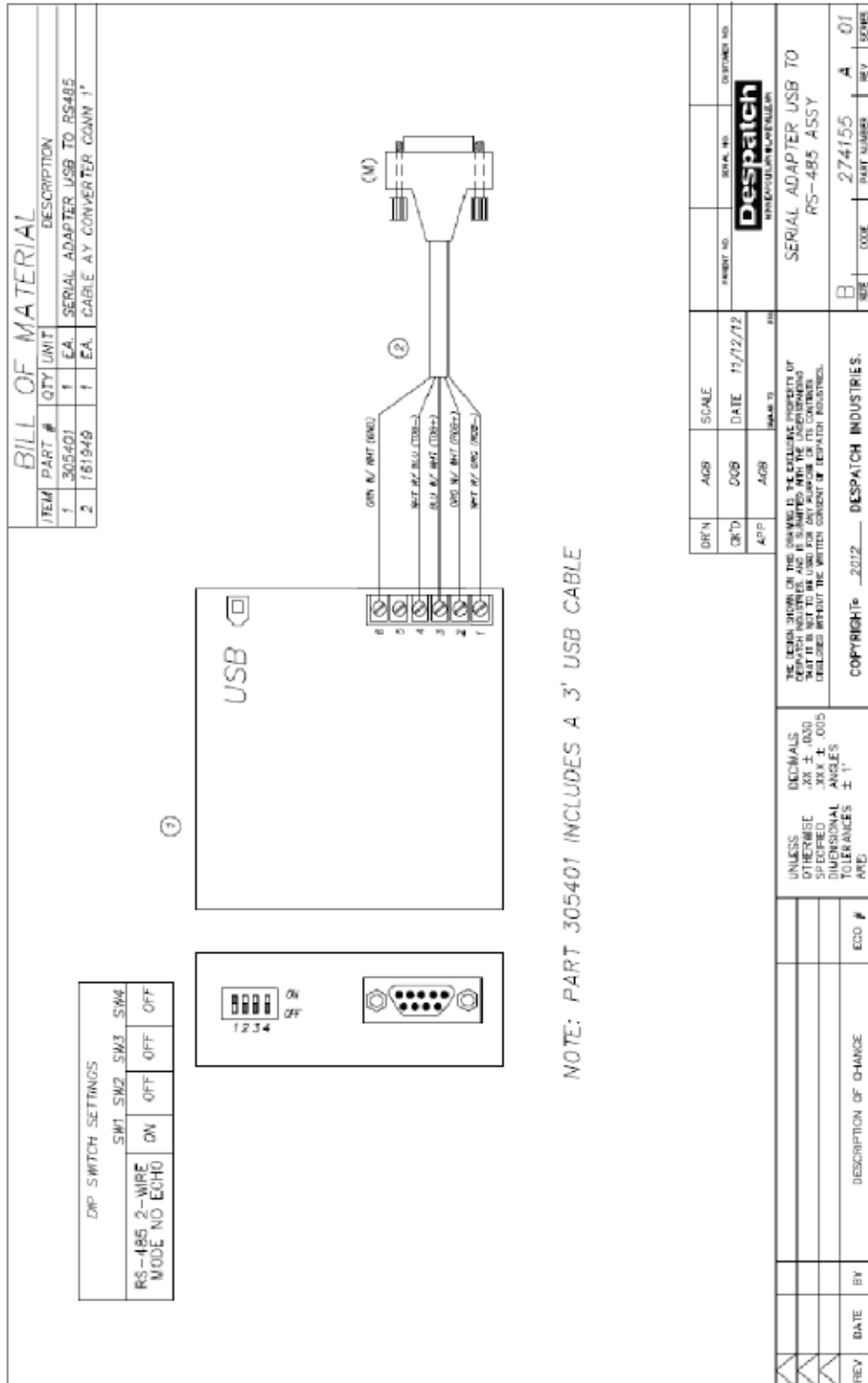


Figure 25. USB Converter Schematic.

8. Appendices

8.1. Standard Products Warranty



Standard Products Product Warranty

Products Covered by this Warranty

This warranty (the "Warranty") applies to the following Despatch products: LEB, LBB, LAC, LCC, LCD, RAD, RFD, TAD, TFD, PN, PTC, PCC.

Parts and Materials

Despatch warrants all parts and materials to be free from defects in material and workmanship for a period of:

1. five (5) years from date of shipment for laboratory oven electric heaters;
2. two (2) years from date of shipment for Protocol 3 and DES 2000 temperature controllers; and
3. one (1) year from the date of shipment, or 2,000 hours of operation, whichever occurs first, for all other components of products covered by this Warranty.

During the applicable Warranty period, Despatch will repair or replace, at Despatch's option, parts and materials covered by this Warranty

Labor

During the first 90 days of the Warranty period, Despatch will pay labor costs incurred to remove defective parts and materials, and to reinstall repaired or replacement parts or materials; provided, however, that Despatch's obligation to pay such labor costs shall be subject to the limitation that the removal and/or reinstallation service must be performed by a Despatch-authorized technician from Despatch's worldwide network of factory-trained professionals at a location within the contiguous United States.

Transportation Costs

All transportation costs to transport defective parts or materials to Despatch, and to transport repaired or replacement parts or materials to Customer, shall be the responsibility of the Customer.

Terms and Conditions

This Warranty shall be deemed valid and binding upon Despatch if and only if the Customer:

1. installs, loads, operates, and maintains the covered product supplied hereunder in accordance with the instruction manual provided upon delivery and product labeling affixed to the subject equipment;
2. if applicable, follows the Emergency Procedure set forth in this Warranty; and
3. contacts Despatch's Helpline at 1-800-473-7373 for assistance in diagnosing and troubleshooting the problem immediately upon discovering any damage or malfunction.

Despatch's reasonable determination as to whether a repair, replacement, or service is covered by this Warranty shall be final and binding.

Exclusions

This Warranty DOES NOT cover:

1. damage or malfunctions, or expenses incurred in the process of diagnosing and/or repairing damage or malfunctions, resulting from any of the following: operator error, misuse, abuse, inadequate preventive maintenance, normal wear and tear, service or modifications by other than Despatch

THE REPRESENTATION AND WARRANTIES SET FORTH HEREIN ARE EXCLUSIVE AND IN LIEU OF, AND CUSTOMER HEREBY WAIVES AND DISCLAIMS RELIANCE UPON, ALL OTHER REPRESENTATIONS AND WARRANTIES OF EVERY KIND WHATSOEVER, WHETHER EXPRESS OR IMPLIED, OR ARISING BY OPERATION OF LAW OR IN EQUITY, OR BY COURSE OF PERFORMANCE OR DEALING OR USAGE OF TRADE, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

THIS WARRANTY IS PERSONAL TO THE CUSTOMER AND MAY NOT BE TRANSFERRED OR ASSIGNED. ALL LIMITATIONS HEREUNDER, HOWEVER, SHALL BE BINDING ON ALL SUCCESSORS AND ASSIGNS OF CUSTOMER.

- authorized technicians, use of the covered product that is inconsistent with the operation manual or labeling, acts of nature (including, without limitation, floods, fire, earthquake, or acts of war or civil emergency), internal or external corrosion, or non-conforming utilities (including, without limitation, electrical, fuel supply, environmental and intake/exhaust installations);
2. repair or replacement of parts or materials designed and intended to be expendable or consumable; refrigerants, filters, lamps;
 3. routine maintenance; or
 4. labor costs incurred for troubleshooting, diagnostics, or testing (except for testing required to verify that a covered defective part or material has been repaired).

Limitations of Liability

Despatch shall not, in any event, be liable for indirect, special, consequential, incidental, or punitive damages or penalties of any kind, including, without limitation loss of revenue, profits or business opportunities resulting from interruption of process or production. In no event shall Despatch be liable for damages in excess of the amounts paid by Customer to Despatch with respect to the applicable product(s). This Warranty does not cover, and Despatch shall not be liable for any losses, costs, damages or expenses resulting from delays in diagnosing or repairing the products, supplying or obtaining replacement parts or materials, strikes, labor stoppages or shortages, fires, accidents, government acts or regulations, or any other causes beyond the control of Despatch.

Non-Compliance By Customer

Despatch reserves the right to suspend and withhold service under this Warranty in the event of non-compliance by the Customer to any terms and conditions of this Warranty or the applicable purchase order or invoice. Further, Despatch shall not be liable for any loss of production, expenses, and inconveniences incurred due to such suspension.

Customer Furnished Equipment Warranty Limitation

This Warranty does not cover diagnosis or repairs of defects in or caused by, lack of performance of, or fitness for purpose of customer-supplied parts or equipment unless specifically noted in the Despatch written order acceptance confirmation.

Performance Commitment

Despatch provides no guarantee of process performance or fitness for purpose, unless specifically noted otherwise in Despatch written order acceptance confirmation. Despatch is providing equipment with design parameters specific only to its equipment.

Procedure Upon Discovery of Defects and Emergencies

In the event Customer becomes aware of any defect in the applicable products, Customer must immediately: (a) shut off fuel or energy supply (gas and electricity), (b) call for emergency assistance, if needed, and (c) notify Despatch Service.

Service
Phone 800-473-7373; International Phone 952-469-8230; Fax 952-469-8193
e-mail service@despatch.com; www.despatch.com

BB7 (12/05/12)

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8.2. Modbus Programming

For information on Modbus programming, refer to the Despatch web page (www.despatch.com) to search for and download the “Modbus Programming Manual” version 3 (Rev 3/13) or later.

8.3. Programming Worksheet

See Section 5.3 for help with completing Programming Worksheet (Table 21).

Table 21. Programming Worksheet.

Profile Name:									
Profile Number:									
Segment	Segment Type	Target Setpoint	Time	Auto Hold Type	Events				
					1	2	3	4	5

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