T2000 Total Control Unit

T2000 Quick Start Guide
NOTICE

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Open Control Solutions also reserves the right to make changes to the specifications of the T2000 and to the information contained in this document at any time without notice.

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This document provides a brief overview of the T2000’s features and sufficient information to get the unit mounted and powered. Refer to the T2000 Installation and Operation Manual for detailed information on wiring I/O, and configuring and using the T2000 (see accompanying Resource CD for PDF version of this manual). The quick start guide and the manual can also be found on OCS’ web site at www.opencontrolsolutions.com.

**WARNING**

This information is provided for qualified personnel only.

Improper installation, service, or maintenance can cause property damage, injury, or death.

Read the installation and operating instructions thoroughly before installing or servicing this equipment.

**WARNING**

Precautionary measures must be observed when installing, operating, and servicing the T2000 in order to prevent shock from voltages present.

If the T2000 is to be installed into an existing control panel, make sure that all breakers are shut off before starting the installation.

All wiring must conform to federal, state, and local electrical codes.

**Description**

The T2000 Total Control Unit (T2000) is a microprocessor-controlled device. The T2000 can be used as a fixed-speed pump controller or a non-intelligent I/O device.

Additionally, the T2000:

- Can perform as a Modbus master device and poll Modbus slave devices through the T2000’s RS-485 interface.
- Can perform as a Modbus slave device and be polled by devices (radios, modems, PLCs) through the T2000’s RS-232 interface.
- Can operate as a stand-alone unit without telemetry.
The installed pump control process enables the T2000 to be easily implemented in lift station or storage tank applications. As a fixed-speed pump controller, the T2000 contains all the hardware and software needed to control up to three motor starters.

**Parts List**

- T2000 Total Control Unit
- Installation kit
- Resource CD
- T2000 Quick Start Guide

**Receipt of Equipment**

When equipment is received, examine the outside of the carton for any damage incurred during shipment. Remove the packing list and the equipment from the shipping carton. Carefully inspect the equipment for damage. Resolve any damage with the local carrier. Report damages to Open Control Solutions (321-435-5010). Include the serial number of the unit and the extent of damage in your report.

**Technical Specifications**

- Box Dimensions: 5.75” X 8.75” X 5.45”
- Supply Voltage: 120VAC +/-10%
- Frequency: 60 HZ
- Current: 0.5A
- Phase Monitor: 240 VAC single- or three-phase; or 480 VAC three-phase using external resistors
- Battery Backup: 12-volt, sealed, lead-acid battery
- Analog Inputs: 4-20mA @ 250ohm /1-5V @ 100K ohm; both inputs are 12-bit accurate
- Digital Input Voltages: 10 - 30 volts AC/DC; or 30 - 300 volts AC/DC with external resistors
- Digital Input Impedance: 6K ohms
- Digital Outputs: 120-240VAC, 60HZ, 1A, Pilot Duty
- Bias: 100mA
- RS-232 Modbus Slave Interface: Modbus ASCII protocol, 9600 baud, 7 data bits, Odd parity, 2 stop bits
- RS-485 Modbus Master Interface: Modbus ASCII or RTU protocol, 1200-9600 baud
- Ethernet Interface (optional): 10base-T; TCP/IP (UDP Datagram); 12-14 VDC; 500 mA
- Autodialer (optional): Onboard V.92 voice modem for announcing alarms through prerecorded voice messages
- ISO+24V / ISOGND: 24 VDC at 60 mA (100 mA max), unregulated, isolated
- Input Protection: M.O.V., Transorb (Transient Voltage Suppressor), and Opto-isolated
- Alarm Relays: 120 VAC, 60HZ, 0.5A, Tungsten; or 0-24VDC, 1.0A
- Alarm Light / Horn: Normally closed contacts
- LCD w/Keypad: 4x20 character Liquid Crystal Display; 12-key keypad is used to page through programmed menu items
- H-O-A Switches: 3 x 3-position switches hardwired to 3 solid state control points for Hand-Off-Auto operation
- Environmental Conditions:
  - Ambient Operating Temperature Range: -10°C to 60°C (14°F to 140°F). The upper temperature limit is 50°C (122°F) when using the recommended backup battery. Note that the LCD display may become unreadable at temperatures below 0°C.
  - Relative Humidity: 0-100%
  - Atmospheric Pressure: 75-106 KPa
  - Overvoltage Category II
  - Pollution Degree 2
- Safety Approval: UL listed for Process Control Equipment (UL1092)

**Features**

- Twelve digital inputs for monitoring level or contact closure.
- Two 12-bit analog inputs offer enhanced accuracy and increased resolution.
- Six digital outputs - four solid state and two contact closure (one normally closed).
- Autodialer (optional) - The T2000 can be ordered with an onboard V.92 voice modem for alarm dial out; an existing unit can be retrofitted at the factory.
- Network adapter (optional): The T2000 can be ordered with an integrated 10/100 network adapter; an existing unit can be retrofitted at the factory.
- Dual double-speed microcontrollers (one for controlling functions; one for communication).
- True RMS AC phase monitor produces accurate and exact voltage readings for single- and three-phase power.
- RS-485 Modbus fieldbus half-duplex serial interface enables communication with industry standard devices.
- Standard RS-232 Modbus interface acts as an interface to external industry standard radios as well as modems and PLCs. (Not available if optional network adapter is installed.)
- 34 LEDs provide system status at a glance.
- Three fail-safe Hand-Off-Auto (HOA) switches.
- Four connectorized wire terminals allow servicing or replacement of the unit without rewiring the control panel. No user configuration straps or jumpers are required.
- 4 x 20-character LCD provides a large area for displaying data. The LCD's contrast is controlled by an onboard temperature sensor that ensures that the screen is easy to read in both high- and low-temperature conditions.
- 12-key membrane switch keypad and soft-power switch offers ease of use when powering up/down the T2000 and when entering T2000 configurations, and viewing and resetting alarms.
- Self-monitoring capabilities include an On state self test and monitoring of radio current and unit temperature.
- For each pump, elapsed run time and average run time meters are provided.
- Telemetry interface enables operators to remotely monitor off-site conditions and control equipment from a central location.
- Mounting options allow the T2000 to be mounted to a front panel, or mounted flush against or stood off from the back plate of a control panel
- Integrated switching power supply
- Surge protection (non-destructive) and on-board voltage regulation
- Battery backup with external battery (12V, 2.6Ah or 12V, 7.0Ah)

### Pin Name / Wiring Definitions

The tables below and on the next several pages provide pin names and descriptions for the T2000.

#### Top Connector 1: P1

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Name</th>
<th>Description</th>
<th>Electrical Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1-1</td>
<td>PHASE_C</td>
<td>Phase C of the three-phase power monitor</td>
<td>120-240VAC, 60HZ, 100mA, 3-phase</td>
</tr>
<tr>
<td>P1-2</td>
<td>PHASE_B</td>
<td>Phase B of the three-phase power monitor</td>
<td>120-240VAC, 60HZ, 100mA, 3-phase</td>
</tr>
<tr>
<td>P1-3</td>
<td>PHASE_A</td>
<td>Phase A of the three-phase power monitor</td>
<td>120-240VAC, 60HZ, 100mA, 3-phase</td>
</tr>
<tr>
<td>P1-4</td>
<td>UNUSED</td>
<td>DO NOT CONNECT</td>
<td>Not Connected</td>
</tr>
<tr>
<td>P1-5</td>
<td>AC_PWR</td>
<td>T2000's AC power</td>
<td>120VAC, 60HZ, 0.5A</td>
</tr>
<tr>
<td>P1-6</td>
<td>AC_NEUT</td>
<td>T2000's AC power neutral</td>
<td>120VAC, 60HZ, 0.5A</td>
</tr>
<tr>
<td>P1-7</td>
<td>TGND</td>
<td>Safety ground</td>
<td>Ground</td>
</tr>
<tr>
<td>P1-8</td>
<td>BAT+</td>
<td>Backup battery positive terminal</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P1-9</td>
<td>BAT-</td>
<td>Backup battery negative terminal</td>
<td>&lt;24V/Not Rated</td>
</tr>
</tbody>
</table>
## T2000 Quick Start Guide

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Name</th>
<th>Description</th>
<th>Electrical Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1-10</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
</tr>
<tr>
<td>P1-11</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
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<tr>
<td>P1-12</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
</tr>
<tr>
<td>P1-13</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
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<td>P1-14</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
</tr>
<tr>
<td>P1-15</td>
<td>Factory Use Only</td>
<td>DO NOT CONNECT</td>
<td>N/A</td>
</tr>
<tr>
<td>P1-16</td>
<td>ALM_HORN</td>
<td>Load side of alarm horn (NO)</td>
<td>120VAC, 60HZ, 0.5A, Tungsten, 0-24VDC, 1A</td>
</tr>
<tr>
<td>P1-17</td>
<td>ALM_LITE</td>
<td>Load side of alarm light relay (NC)</td>
<td>120VAC, 60HZ, 0.5A, Tungsten, 0-24VDC, 1A</td>
</tr>
<tr>
<td>P1-18</td>
<td>ALM_PWR</td>
<td>Line side of alarm relays</td>
<td>120VAC, 60HZ, 1A, 0-24VDC, 2A, Source</td>
</tr>
<tr>
<td>P1-19</td>
<td>AUX_OUT</td>
<td>Load side of auxiliary relay</td>
<td>120-240VAC, 60HZ, 1A, Pilot Duty</td>
</tr>
<tr>
<td>P1-20</td>
<td>AUX_PWR</td>
<td>Line side of auxiliary relay</td>
<td>120-240VAC, 60HZ, 1A, Source</td>
</tr>
<tr>
<td>P1-21</td>
<td>MTR3_STR</td>
<td>Load side of motor starter 3 relay</td>
<td>120-240VAC, 60HZ, 1A, Pilot Duty</td>
</tr>
<tr>
<td>P1-22</td>
<td>MTR2_STR</td>
<td>Load side of motor starter 2 relay</td>
<td>120-240VAC, 60HZ, 1A, Pilot Duty</td>
</tr>
<tr>
<td>P1-23</td>
<td>MTR1_STR</td>
<td>Load side of motor starter 1 relay</td>
<td>120-240VAC, 60HZ, 1A, Pilot Duty</td>
</tr>
<tr>
<td>P1-24</td>
<td>STR_PWR</td>
<td>Line side of motor starter relays</td>
<td>120-240VAC, 60HZ, 3A, Source</td>
</tr>
</tbody>
</table>

### Top Connector 2: P3

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Name</th>
<th>Description</th>
<th>Electrical Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3-1</td>
<td>ST_ADDR0</td>
<td>Station address bit 0 (bit value=1)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-2</td>
<td>ST_ADDR1</td>
<td>Station address bit 1 (bit value=2)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-3</td>
<td>ST_ADDR2</td>
<td>Station address bit 2 (bit value=4)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-4</td>
<td>ST_ADDR3</td>
<td>Station address bit 3 (bit value=8)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-5</td>
<td>ST_ADDR4</td>
<td>Station address bit 4 (bit value=16)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-6</td>
<td>ST_ADDR5</td>
<td>Station address bit 5 (bit value=32)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-7</td>
<td>ST_ADDR6</td>
<td>Station address bit 6 (bit value=64)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>PIN#</td>
<td>Name</td>
<td>Description</td>
<td>Electrical Rating</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
<td>-----------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>P3-8</td>
<td>ST_ADDR7</td>
<td>Station address bit 7 (bit value=128)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-9</td>
<td>ST_ADDR8</td>
<td>Station address bit 8 (bit value=256)</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-10</td>
<td>GND</td>
<td>Station address ground</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-11</td>
<td>INV'</td>
<td>Invert data</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-12</td>
<td>SWAP</td>
<td>Swap data</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-13</td>
<td>CFG_BIT2</td>
<td>Unused - DO NOT CONNECT</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-14</td>
<td>CFG_BIT3</td>
<td>Unused - DO NOT CONNECT</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-15</td>
<td>GND</td>
<td>Configuration ground</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P3-16</td>
<td>EARTH_GND</td>
<td>Earth ground/lanyard</td>
<td>Not Connected</td>
</tr>
<tr>
<td>P3-17</td>
<td>Unused</td>
<td>Unused</td>
<td>Not Connected</td>
</tr>
<tr>
<td>P3-18</td>
<td>Unused</td>
<td>Unused</td>
<td>Not Connected</td>
</tr>
</tbody>
</table>

**Bottom Connector 1: P2**

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Name</th>
<th>Description</th>
<th>Electrical Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P2-1</td>
<td>MTR1_RUN</td>
<td>Motor 1 run digital monitor input</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-2</td>
<td>MTR2_RUN</td>
<td>Motor 2 run digital monitor input</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-3</td>
<td>MTR3_RUN</td>
<td>Motor 3 run digital monitor input</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-4</td>
<td>EXT_PM</td>
<td>External phase monitor digital monitor input</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-5</td>
<td>IN_COM_1</td>
<td>Common return for motor run and external phase monitor inputs</td>
<td>10-30VAC/DC@40mA RTN</td>
</tr>
<tr>
<td>P2-6</td>
<td>LOW_LVL</td>
<td>Low level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-7</td>
<td>OFF_LVL</td>
<td>Off level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-8</td>
<td>LEAD_LVL</td>
<td>Lead level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-9</td>
<td>LAG1_LVL</td>
<td>Lag1 level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-10</td>
<td>LAG2_LVL</td>
<td>Lag2 level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-11</td>
<td>HIGH_LVL</td>
<td>High level digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>PIN#</td>
<td>Name</td>
<td>Description</td>
<td>Electrical Rating</td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>P2-12</td>
<td>AUX_IN</td>
<td>Auxiliary digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-13</td>
<td>ALM_SIL</td>
<td>Alarm silence switch digital monitor input; common at pin P2-14</td>
<td>10-30VAC/DC@10mA</td>
</tr>
<tr>
<td>P2-14</td>
<td>IN_COM_2</td>
<td>Common return for input levels, aux inputs, and alarm silence switch</td>
<td>10-30VAC/DC@80mA RTN</td>
</tr>
<tr>
<td>P2-15</td>
<td>ISOGND</td>
<td>Internally supplied 24VDC bias source return</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-16</td>
<td>ISO+24V</td>
<td>Internally supplied 24VDC bias source voltage</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-17</td>
<td>TXD_232</td>
<td>RS-232 transmit data to external device</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-18</td>
<td>RXD_232</td>
<td>RS-232 receive data from external device</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-19</td>
<td>GND</td>
<td>RS-232 ground</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-20</td>
<td>TGND</td>
<td>Shield for analog monitor signals</td>
<td>Ground</td>
</tr>
<tr>
<td>P2-21</td>
<td>ANALOG2+</td>
<td>4-20mA+ signal from transducer; - signal at pin P2-23</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td></td>
<td>(C2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2-22</td>
<td>ANALOG01+</td>
<td>0-5VDC or 4-20mA+ signal from transducer; - signal at pin P2-23;</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td></td>
<td>(C1)</td>
<td>jump pin P2-24 to pin P2-23 for a 4-20mA C1 signal</td>
<td></td>
</tr>
<tr>
<td>P2-23</td>
<td>ANALOG-</td>
<td>- signal return for both analog inputs C1 and C2 at P2-22 and P2-21</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P2-24</td>
<td>SHUNT</td>
<td>250 ohm shunt resistor; jump to P2-23 with 4-20mA signal for C1 at Ps-22 only</td>
<td>&lt;24V/Not Rated</td>
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</tbody>
</table>
Bottom Connector 2: P4

<table>
<thead>
<tr>
<th>PIN#</th>
<th>Name</th>
<th>Description</th>
<th>Electrical Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4-1</td>
<td>Unused</td>
<td>Reserved for future use; do not connect</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-2</td>
<td>Unused</td>
<td>Reserved for future use; do not connect</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-3</td>
<td>RS485_B</td>
<td>RS-485 serial interface B</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-4</td>
<td>RS485_A</td>
<td>RS-485 serial interface A</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-5</td>
<td>EX_SHIELD</td>
<td>Cable shield for RS-485 or RS-232 cable</td>
<td>Ground</td>
</tr>
<tr>
<td>P4-6</td>
<td>EX_GND_RAD</td>
<td>RS-232 ground</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-7</td>
<td>RTS_RAD</td>
<td>RS-232 request to send</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-8</td>
<td>EX_TXD_RAD</td>
<td>RS-232 transmit data to external device</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-9</td>
<td>EX_RXD_RAD</td>
<td>RS-232 receive data from external device</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-10</td>
<td>CTS_RAD</td>
<td>RS-232 clear to send</td>
<td>&lt;24V/Not Rated</td>
</tr>
<tr>
<td>P4-11</td>
<td>Unused</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>P4-12</td>
<td>Unused</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>P4-13</td>
<td>Unused</td>
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<tr>
<td>P4-14</td>
<td>Unused</td>
<td>Not Connected</td>
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</tr>
</tbody>
</table>

**Safety Precautions**

Review the following statements before installing, servicing, or replacing the T2000 Total Control Unit (T2000) or any of its components.

**General Precautions**

- Only trained and qualified personnel should install, service, or replace this equipment.
- Carefully read the installation and wiring instructions before connecting the T2000 to its power source.
- Do not work on the T2000, or connect or disconnect any of its cables, during periods of lightning activity.
- To prevent overheating the T2000, do not operate it in an area that exceeds the maximum recommended temperature of -10°C to 60°C (14°F to 140°F). The upper temperature limit is 50°C (122°F) when using the recommended backup battery.
- Ensure that the unit is connected to earth ground during normal use.
- Precautionary measures must be observed when installing, operating, and servicing the T2000 in order to prevent shock from voltages present.
- If the T2000 is to be installed into an existing control panel, make sure that all breakers are shut off before starting the installation.
- All wiring should conform to federal, state, and local electrical codes.
Working with the T2000

Before working with the T2000 where the removal of components is necessary, perform the following steps in the sequence indicated:

1. Power down the unit.
2. Turn off all circuit breakers to the T2000.
3. Ensure that any cables connected to the T2000 will not become entangled in or caught on anything in the surrounding area.

**IMPORTANT:** If the T2000’s Power LED is not lit, you should assume that the T2000 is still powered. The Power LED indicates only that the T2000 is in the off state, not that AC power has been removed. To remove power, you must turn off the external circuit breaker.

When disconnecting a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs; when disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. When pulling connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before connecting a cable, make sure both connectors are correctly oriented and aligned.

Protecting Against Electrostatic Discharge

Static electricity can harm delicate components inside the T2000. To prevent static damage, put on an electrostatic discharge wrist strap before touching any of the T2000’s electronic components.

In addition to the preceding precautions, the following steps can be taken to prevent damage from electrostatic discharge (ESD):

- When unpacking a static-sensitive component from its shipping carton, do not remove the component’s antistatic packing material until ready to install the component in the T2000. Be sure to put on an electrostatic discharge wrist strap before unwrapping the antistatic packaging.
- When transporting a sensitive component, first place it in an antistatic container or packaging.
- Handle all sensitive components in a static-safe area. Place the equipment on a grounded surface. If possible, use antistatic floor pads and workbench pads.

**Note:** Contact DFS if electrostatic discharge packaging is needed for return shipments. See Return Authorization (RA) Procedure, p. 10 for more information on returning equipment.
**Using the T2000**

When using the T2000, observe the following safety guidelines:

- To help prevent electric shock, wire the T2000 and peripheral power cables into properly grounded power sources.
- Be sure nothing rests on the T2000’s cables and that the cables are not located where they can be stepped on or tripped over.

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**INSTALLATION**

**Site Selection**

When selecting a site for the T2000, keep the following in mind:

- The T2000 requires a 120 VAC power supply.
- The T2000 is designed to operate at recommended temperature range of -10°C to 60°C (14°F to 140°F). The upper temperature limit is 50°C (122°F) when using the recommended backup battery.
- The T2000 is intended to be permanently installed in a NEMA 12 or higher rated panel that prevents access to live parts without a tool.
- Attention should be given to the location of the T2000 to provide accessibility for wiring and servicing. Leave enough space around the T2000 to access the T2000’s fuse and to remove the connectorized terminal strips. Install the T2000 in the panel at a position where the LCD display can be read comfortably. The LCD is best viewed at slightly below eye level.

**Mounting Instructions**

The T2000 is intended to be permanently installed in a NEMA 12 or higher rated panel that prevents access to live parts without a tool. The T2000 can be mounted in a control panel in several different ways. The unit can be mounted flush to the back plate of the panel, stood off the back plate, or mounted to a front panel. Mounting brackets are provided with the T2000 that can be used to mount it in any of these positions. Optional connectors to facilitate the various types of mountings are available as shown on page 13, “Attaching Connectors” and may be specified as described in Appendix C: Parts List in the T2000 Installation and Operation Manual.

**IMPORTANT**

A qualified technician should install the T2000.

Precautionary measures must be observed when installing, operating, and servicing the T2000 in order to prevent shock from voltages present.

If the T2000 is to be installed into an existing control panel, make sure that all breakers are shut off before starting the installation.
Snap-In Mount
With the snap-in mount option, the mounting bracket is attached to the back of the control panel, and the T2000 is snapped into place. With this mounting option, the T2000 can be installed and removed quickly and easily.

This option uses the T2000 Snap-In Installation Kit. See Appendix C: Parts List in the T2000 Installation and Operation Manual.

The dimensional drawing on the next page is provided to aid in installation. If a panel cutout is required, the T2000 can be installed with or without edge molding around the front-panel opening. The panel cutout is different for each mounting configuration. See "Control panel installation with T2000 mounted to dead front" and "Control panel installation with T2000 mounted to front panel," on the next page below the dimensional drawing.

Dead-Front Panel Mount
This mounting option uses a mounting bracket that is attached to the front of a control panel. With this mounting option, the T2000 is attached to the mounting bracket with screws instead of being snapped into place.

This option uses the T2000 Dead-Front Mount Installation Kit. See Appendix C: Parts List in the T2000 Installation and Operation Manual.
Control panel installation with T2000 mounted to dead front

Control panel installation with T2000 mounted to front panel
Attaching Connectors

The graphic to the right depicts how each of the T2000's three optional connector types can be attached to the unit. The first option uses the Spring-Clamp Connector Tool, which can be ordered from OCS. See Appendix C: Parts List in the T2000 Installation and Operation Manual for information on ordering connectors and the connector tool.
Wiring AC Power

**CAUTION**

Maximum wire size to T2000 connectors is 12 AWG.

Use copper conductors only with a minimum rating of 75°C.

Recommended circuit breaker is 10 Amp maximum.

When using connectors with screw-type terminals, tighten screw terminals to a maximum 7 in-lb (.79 Nm).

All AC source power wired to the T2000 should be from the same leg of the three-phase system. (Diagrams in this section show Phase C (L3) being used.)

The Power LED does not indicate that AC power has been removed. Even if the T2000’s Power LED is not lit, you should assume that the T2000 is still powered. To remove power, you must turn off the external circuit breaker.

The T2000 operates from 120 VAC. Verify the input voltage on the T2000’s connector label before wiring.

Three terminals are provided for wiring power:

- P1-5, AC_PWR (AC power)
- P1-6, AC_NEUT (AC neutral)
- P1-7, TGND (earth ground)

Terminal P1-7 is designated Earth or Safety ground. The T2000’s case is also connected to the TGND terminal.

Wire in accordance with Federal, State, and Local Electrical Codes.

**IMPORTANT:** The transformer must provide AC neutral. Diagrams for wiring to a typical three-phase, 4-wire, 240 volt transformer that provides AC neutral and to a typical three-phase, 3-wire 480 volt transformer with no neutral provided can be found below and on the next page.

Note that these diagrams are for typical installations. If your installation deviates from that shown here, refer to the National Electrical Code® (NEC®) Handbook.
Typical 240 Volt, 4-Wire Transformer

Connect T2000 chassis to earth ground.

Typical 480 Volt, 3-Wire Transformer

Connect T2000 chassis to earth ground.
**General Operating Instructions**

This section provides an overview of the T2000’s user interface. For detailed descriptions and instructions on use, refer to the *T2000 Installation and Operation Manual*, which can be found on the Resource CD and on the Open Control Solutions website (www.OpenControlSolutions.com).
On/Off Button and Power LED
Press and hold the T2000’s soft power On/Off key to turn the unit on and off. The Power LED indicates the state (on or off) of the T2000.

⚠️ WARNING ⚠️
The Power LED does not indicate that AC power has been removed. Even if the T2000’s Power LED is not lit, you should assume that the T2000 is still powered. To remove power, you must turn off the external circuit breaker.

Connectorized Terminals
The T2000’s four connectorized wire terminals (P1, P2, P3, and P4) allow the unit to be serviced or replaced without rewiring the control panel. No user configuration straps or jumpers are required.

Keypad and LCD
The 4-line x 20-character LCD, in conjunction with the 12-key keypad, provides an interface for configuring the T2000, viewing and resetting alarms, and analyzing status information. The keys on the T2000’s keypad can be used to page through menus items, scroll through configuration options, and enter numeric data. The keypad includes the numbers 0-9, scrolling keys (up ▲, down ▼, left ◀, and right ►), an ENTER key, and an ESC (escape) key. Some keys have two functions. For example, the number 2 key is also the “up” scrolling key. The function of the key is dependent on the T2000’s current mode.

H-O-A Switches and LEDs
Three Hand-Off-Auto (H-O-A) switches on the T2000’s front panel are provided to manually override the T2000’s automated control. They can be used to manually control the devices (for example, pumps) that are connected to the unit. The H-O-A switches are fail-safe; they remain operational even if the T2000 fails or loses power.

Each of the T2000’s H-O-A switches has an LED that provides the status of the corresponding device. Under normal operation, the LEDs indicate if the device is on or off. A flashing LED indicates that a pump motor failed to start or stop when controlled by the T2000.

Activity LEDs
The LEDs that appear on either side of the LCD screen can be used in conjunction with information on the LCD to provide status at a glance, for example, the current staging level of the well or tank.
**Alarm Silence Button and LED**

The Alarm LED flashes when there are active alarms and stays continuously lit until all alarms have cleared and all corresponding alarm messages have been viewed. The Alarm LED is cleared when the alarm screen is exited and there are no active alarms. The Silence key is used to silence an alarm horn connected to the T2000.

**CPU Fault LED**

The CPU Fault LED is used to indicate a fault with the microcontroller. When this LED is lit (flashing or steady), all automated controls are disabled. Only using the H-O-A switches, which continue to function under a CPU Fault condition, can continue operation of the pumps. The disabled state of the alarm light relay activates an alarm light connected to the T2000.

**Receive (RX Data) and Transmit (TX Data) LEDs**

The T2000 can communicate through the service port located on its front panel and through its telemetry interfaces – RS-232 (slave) and RS-485 (master). RX and TX Data LEDs are part of the RS-232 and service port interfaces and are provided to verify the communications function. The RX Data LED strobes each time the T2000 receives data through either its service port or R2-232 interface; the TX Data LED strobes each time the T2000 transmits data.

**Service Port**

The T2000’s front panel features an RS-232 interface that can be used for diagnostics and configuration storage and updating.

**Digital Input and Output LEDs**

At the top and bottom of the T2000’s front panel are LEDs that work independently of the T2000’s internal computer. These LEDs provide a visual indication that the corresponding input or output is on.

**Telemetry Configuration**

Setting up the T2000 as a component of the telemetry system enables you to remotely monitor conditions at the site and control equipment from a central location. For example, you can determine if a pump is currently running and force it on if necessary.

The T2000 provides support for Modbus slave and master devices via its R2-232 and RS-485 serial interfaces.

- The T2000’s RS-232 Modbus slave interface provides connectivity to industry-standard Modbus-compatible radios, modems, and PLCs. The T2000’s default
RS-232 communication settings are ASCII protocol, 9600 baud, 7 data bits, Odd parity, 2 stop bits. These settings are not configurable. However, the T2000 can be ordered or factory reconfigured to RTU protocol, 9600 baud, 8 data bits, E/O/N parity, 1 stop bit.*

- The T2000's RS-485 Modbus 9600-baud serial interface enables it to perform as a Modbus master device and poll slave devices at 1200-9600 baud using Modbus ASCII or RTU protocol.

*The T2000 cannot be polled as a Modbus slave via its RS-232 serial interface if the optional network adapter is installed.

For detailed instructions on integrating the T2000 with your telemetry system, see Chapter 6: Telemetry Configuration in the *T2000 Installation and Operation Manual*.

### Key-invoked Functions

Detailed information on these key-invoked functions can be found in the *T2000 Installation and Operation Manual*.

<table>
<thead>
<tr>
<th>Function Description</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>View process ID and version level</td>
<td>With the T2000 powered, press and hold the 3 button</td>
</tr>
<tr>
<td>View serial number, station address, radio configuration, and firmware version</td>
<td>With the T2000 powered, simultaneously press and hold the 3 and Alarm Silence buttons</td>
</tr>
<tr>
<td>Restore default configurations</td>
<td>Press and hold the 8 button while cycling power</td>
</tr>
<tr>
<td>Adjust LCD contrast</td>
<td>Press and hold the 5 button while cycling power</td>
</tr>
</tbody>
</table>

### Maintenance

The T2000 itself is designed for a minimum amount of maintenance. It is more important to maintain the station and the components connected to the T2000.

When cleaning the T2000's front panel, use only mild detergents and a damp rag. Do not use solvents to clean the T2000's front panel.

Recommended Backup Batteries

- 12V, 7.0 Ah Rechargeable Battery (Part No. DFS-00363-008-01)
- 12V, 2.6 Ah Rechargeable Battery (Part No. DFS-00363-008-02)
The T2000001 includes one replaceable fuse. If this fuse should fail, replace it with a new identical one (.375AT).

**Replacement Parts**

Parts should only be replaced with parts recommended and approved by Open Control Solutions. Placing unapproved parts in the T2000 voids the safety certification. See the Return Authorization (RA) Procedure (next section) for instructions on obtaining replacement parts.

**Return Authorization (RA) Procedure**

In the event that a product fails, during or after the warranty period, it may be returned to Open Control Solutions to be repaired or replaced.

All RA’s will be subject to standard shipping and handling charges. Standard shipping charges will be based on UPS ground, please advise if other arrangements are needed (UPS Red, FedEx, Pickup, Freight...). Standard cost of repairs and shipping charges can be obtained by contacting our Sales Department by phone or e-mail.

**STEP 1:** Replace the failed product with a spare product of the same type, if one is available.

**STEP 2:** Contact Open Control Solutions in one of the following ways to receive an RA#:

- Email OCS at sales@opencontrolsolutions.com.
- Call OCS at 321-435-5010 during normal operating hours.

The following information must be provided.

- Customer/Utility Name and Ship to Address
- Contact Name and Phone Number
- Products to be returned and Serial Numbers
- Detailed description of failure
- PO#

**Note:** The lack of "Detailed description of failure" could result in a bench test fee and equipment returned due to the inability to properly determine the nature of the failure or testing resulting in "No Problem Found."
STEP 3: Pack the wrapped product in a sturdy box filled with popcorn-type or bubble wrap packing material. Include a packing slip with the following information:

- Product model, serial number, probable cause of failure, and the RA number
- Shipping address
- Shipping instructions (shipping costs greater than UPS ground are charged to the customer)

STEP 4: Address the box to:
RA Department # [the RA number you received here]
Open Control Solutions
605 N. John Rodes Blvd.
Melbourne, FL 32934-9105

STEP 5: Ship the box to OCS using any typical shipping carrier (for example, UPS, FedEx, etc.). If circumstances permit, have an OCS employee hand carry the package to the headquarters for you. NOTE: OCS employees are not permitted to hand carry unpacked modules.

Products are typically repaired and shipped back to the customer within a 2-week period starting at the time the product reaches the RA Department. If additional information is required during the repair of the module(s), the OCS RA department will contact you.

To get information on the progress of any of your equipment in for repair, contact the OCS Sales Department at sales@opencontrolnsolutions.com or 321-435-5010.

Replacement of equipment may be necessary in the event that the equipment and/or parts are unrepairable. Warranty equipment will be replaced with out prior notification as warranty replacement. The customer will be notified by phone, if equipment not under warranty cannot be repaired, with information of available options.

OCS reserve the right to return any material received without an RA# or not conforming to the requirements of this RA process.

WARRANTY

Open Control Solutions (OCS) offers a three (3) year return-to-factory warranty covering defects in materials and workmanship.