SEL-DTA2
Display/Transducer Adapter

Instruction Manual

20070123

SCHWEITZER ENGINEERING LABORATORIES, INC.

⚠CAUTION

Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.

⚠DANGER

Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.

⚠DANGER

Contact with instrument terminals can cause electrical shock that can result in injury or death.

⚠WARNING

Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.

⚠WARNING

Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.

⚠ATTENTION

Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.

⚠DANGER

Débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.

⚠DANGER

Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessuers ou la mort.

⚠AVERTISSEMENT

Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser avec d'autres personnes ou endommager l'équipement.

⚠AVERTISSEMENT

L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.

PMDTA2-01

Table of Contents

This page intentionally left blank

List of Tables

This page intentionally left blank

List of Figures

This page intentionally left blank

Manual Change Information

The date code at the bottom of each page of this manual reflects the creation or revision date. The table below summarizes changes in this manual to date, listing the most recent revisions at the top.

Release Date	Summary of Changes in this Release
This *Manual Change Information* section is provided as a record of all changes made to this manual since the initial release.	
20070123	Appendix A: Updated for firmware version R212
20020329	Reissued entire manual with the following changes: Updated formatting of entire manual Reverse of Title Page: Added warranty statement and password warning Section 2: Clarified Fast Meter description Section 3: Clarified baud rate support for SEL-300 series relays. Added description of strong passwords. Section 5: Clarified Checkout Procedure Appendix A: Updated Relay Compatibility table
970417	Reissued entire manual with the following changes: Updated formatting of entire manual Appendix A: Added Relay Compatibility table

This page intentionally left blank

Section 1
Introduction

Getting Started

This instruction manual provides descriptive information and instructions for the SEL-DTA2 Display/Transducer Adapter. The manual is divided into sections with the following information:

Section 1: Introduction and Specifications. General information.

Section 2: Specifications. Detailed technical descriptions of each feature.

Section 3: Communications. User interface and protocol.

Section 4: Installation. Installation and configuration.

Section 5: Maintenance and Testing. Initial checkout and tests.

Appendix A: Firmware Versions and Relay Compatibility. Listings of firmware versions and compatible relays.

Overview

The SEL-DTA2 Display/Transducer Adapter offers a simple and economical on-line interface to the SEL family of digital relays.

The features of the SEL-DTA2 include:

- Two-line, 40-column, high contrast liquid crystal display supplies relay information.
- Displays new faults as they occur as a visual alert.
- Maintains history of 30 short event reports.
- Furnishes visual alert of relay status warnings and failures.
- Displays relay status on demand.
- Isolated RESET input resets fault location transducers and contact outputs.
- Output relay contact for alarm.
- Output relay contact acknowledges RESET input.
- Five output relay contacts identify fault type.
- Eight programmable analog transducer channels proportional to transmission line voltages, currents, power, or fault distance.
- Internal power supply for reliable operation.
- Automatic self-testing ensures continuous reliable operation.
- EIA-232 communications.
- Compact 1.75" cabinet allows simple installation in standard 19" relay rack.

General Description

The SEL-DTA2 serves as an extension to the SEL family of digital relays. New faults are automatically captured, stored in a 30-event fault history, and displayed, effectively eliminating the need for a separate automatic message output device. The SEL-DTA2 also provides access to metering and relay status information. A set of eight voltage outputs and eight current outputs presents fault and meter data to monitor and control equipment.

The SEL-DTA2 provides two communications ports. Port 1 may be used for changing the analog output scaling and other settings, while Port 2 links to the relay for communications. Refer to *Relay Compatibility on page A.2 in Appendix A: Firmware Versions and Relay Compatibility* for a list of compatible SEL devices.

Section 2
Specifications

General Specifications

Display Functions
Three primary sets of display data:
- Faults (including fault location), metering, and target relay self-test status
- Line-by-line scrolling of fault and status data
- Automatic conditions updating of meter data
  - Standard Meter: Updates approximately every five seconds
  - Fast Meter: Updates approximately every one-half second
- 30-event fault history

Self-Testing
Stall timer monitors processor
Setting checks
RAM, ROM, and display tests

Dielectric Strength
Optoisolated input, relay outputs, and power supply routinely tested at 3000 Vdc for 10 seconds.

Interference Tests
Optoisolated input, relay outputs, and power supply
IEEE C37-90 SWC test (type tested)
IEC 60255-6 interference test (type tested)

Impulse
Optoisolated input, relay outputs, and power supply
IEC 60255-5 0.5 joule, 5000 volt test (type tested)

RFI Tests
Type tested in field from a 1/4-wave antenna driven by 20 watts at 150 MHz and 450 MHz, randomly keyed on and off at a distance of one meter from unit.

Unit Weight
5.0 pounds (2.3 kg)

Operating Temperature
–4° to +158°F (–20° to +70°C)

Transducer Channels
Current and voltage are simultaneously available for each of the eight channels.
Channels assigned to metering functions automatically update regardless of display mode.

Current Outputs
Option 1: –1 to 1 mA range
Option 5: –5 to 5 mA range
10 V load compliance
± 0.2% accuracy at full scale
> 2.25 mega ohms output impedance

Voltage Outputs
–5 to 5 V range
± 0.2% accuracy at full scale
10 mA maximum load current

Control Input Voltage
48 V:	30 to 60 Vdc
125 V:	80 to 150 Vdc
250 V:	150 to 300 Vdc

Power Supply
48/125 V:	36 to 200 Vdc, 85 to 140 Vac; 12 watts
250 V:	85 to 350 Vdc, 85 to 264 Vac; 12 watts

Display Modes

The following is a description of all SEL-DTA2 display modes, controls, inputs, and outputs.

The front-panel pushbuttons control display modes and scrolling. The **{SCROLL}** pushbuttons repeat if held in the asserted state.

Faults

There are two ways to enter the FAULTS mode.

Press the front-panel **{FAULTS}** pushbutton.

New faults reported by the relay preempt all other display modes and place the instrument in the FAULTS mode.

Pressing the front-panel **{FAULTS}** pushbutton displays the last two validated faults reported to the SEL-DTA2 by the relay. Press the **{SCROLL}** pushbuttons to view the last 30 validated faults. If no faults have been captured since power up, the instrument displays `FAULT HISTORY EMPTY`.

Display contents are determined by the display window position within the 30-event fault history. *Figure 2.1* illustrates an example fault history, with the window positioned to display the last two faults (as if a user entered the mode recently).

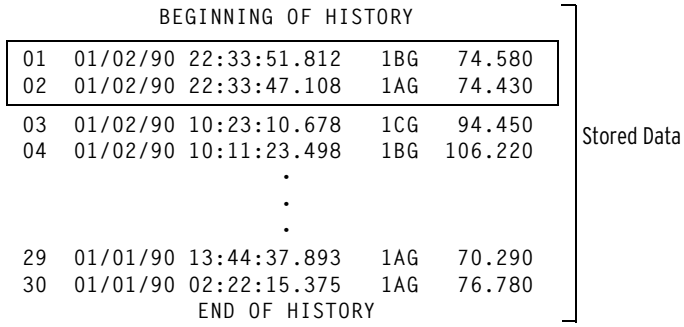

Figure 2.1 FAULTS Mode Initial Window Positioning

Pressing the **{SCROLL DOWN}** pushbutton once changes the display window position as shown in *Figure 2.2*. View any two faults in the 30-event fault history using the **{SCROLL UP}** and **{SCROLL DOWN}** pushbuttons.

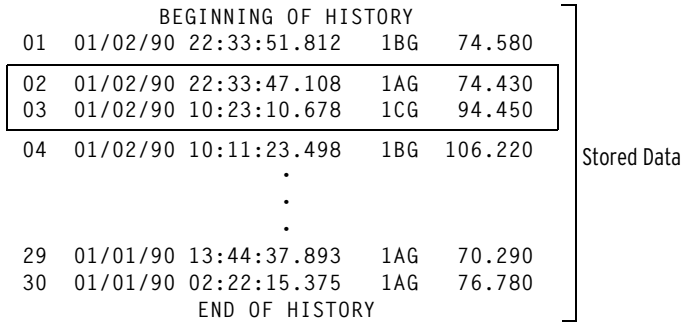

Figure 2.2 FAULTS Mode Display Window After Scroll Down

Faults are numbered sequentially from newest to oldest; the latest fault is assigned the number "1," oldest faults are discarded as history length exceeds 30 lines. The assigned number appears in display columns 1–2. Columns 5–12 and 14–25 contain the date and time of the fault, respectively; columns 29–31 show fault type; columns 35–40 indicate fault location.

When the relay sends a fault report to the SEL-DTA2, the report is checked against a settable fault location window (see the **SET** command description). If the fault lies within this window, the current display mode is preempted and the SEL-DTA2 automatically enters the FAULTS mode. The SEL-DTA2 indicates the receipt of the new fault by adding the line NEW FAULT to the top of the fault list (as shown in *Figure 2.3*) in blinking characters.

```
                NEW FAULT
01  01/02/90 22:33:51.812   1BG   74.580
```

Figure 2.3 New Fault Display

If any transducer outputs are programmed to present the fault location, these channels are updated by the rules outlined in the **SET** command description. The contact outputs reflect fault information as presented in the Contact Outputs section.

Pressing any active front panel control acknowledges the fault and activates the FAULTS mode functions as previously described. If both new fault(s) and relay status warnings exist and are not acknowledged, the first line is modified as shown in *Figure 2.4*.

```
    NEW FAULT & RELAY STATUS WARNING
01  01/02/90 22:33:51.812   1BG   74.580
```

Figure 2.4 New Fault/Relay Status Warning Display

The SEL-DTA2 remains in the FAULTS mode until another display mode is selected. Also, if all new faults have been acknowledged, the FAULTS mode can be preempted by the status mode via detection of a relay status warning.

METER Commands: Access Metering Data or Reset Demand Registers

METER displays meter information; demand and peak-demand information when available; resets demand; or resets peak demand of the selected relay on command (where applicable).

Press **{METER}** to select **METER** commands:

```
METER      (METER   to accept, scroll to
            change, other keys to exit)
```

Use the scroll keys to select one of the following:

METER (instantaneous)

METER D (demand)

METER RD (reset demand)

METER RP (reset peak)

Press **{METER}** again to send the command. Reset functions prompt you for a confirmation. Press scroll up for YES to confirm, scroll down for NO to reject.

Not all SEL relays support the METER D, METER RD, and METER RP functions. Refer to your relay instruction manual to determine which METER functions are supported.

The meter display contains up to eight lines of data, the first two are displayed when the METER mode is activated. View the remaining lines of the meter display by using the **{SCROLL DOWN}** and **{SCROLL UP}** pushbuttons. As shown in *Figure 2.5*, this mode uses the following display format:

Line 1. Display line one contains phase current data in rms amps. When Fast Meter is available and enabled, or the SEL-DTA2 is connected to an SEL-121F Relay, residual current in rms amps is displayed following the phase currents.

Line 2. Display line two contains the real power in MW and reactive power in MVAR. When Fast Meter is available and enabled, three times the negative-sequence current (3I2) in rms amps is displayed preceding the power quantities.

Line 3. Display line three contains phase-to-neutral voltage data in rms kV. When Fast Meter is available and enabled, three times the zero-sequence voltage (3V0) in rms kV is displayed following the phase-to-neutral voltages. If the SEL-DTA2 is connected to an SEL-121F Relay, the synchronizing voltage (VS) in rms kV is displayed following the phase-to-neutral voltages.

Line 4. Display line four contains phase-to-phase voltage data in rms kV. If Fast Meter is available and enabled, three times the negative-sequence voltage (3V2) in rms kV is displayed following the phase-to-phase voltages.

Additional lines containing demand and peak-demand meter values are available when the SEL-DTA2 is connected to a relay that supports those functions.

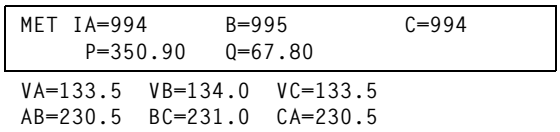

Figure 2.5 Example Meter Display

The SEL-DTA2 remains in the METER operating mode until a new fault is reported, the mode is manually exited by pressing the **{CLEAR}** pushbutton, or another display mode is activated by pressing the corresponding pushbutton. Additionally, the METER mode can be pre-empted by the STATUS mode via detection of a relay status warning.

Pressing **{METER}** once toggles display updating, showing the present meter values until the button is pressed again. Pressing **{METER}** an even number of times freezes the meter display. A frozen meter display is identified by a ":" following the meter quantity label as shown in *Figure 2.6*. Press **{METER}** again to release the display. The analog output channels are continuously updated regardless of display mode.

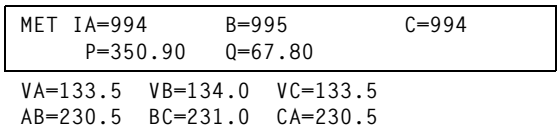

Figure 2.6 Example Frozen Meter Display

Standard Meter. The instrument updates the display with new data approximately every five seconds.

Fast Meter. The SEL-DTA2 is capable of updating and displaying meter data every 0.5 seconds using binary Fast Meter data transfer. The SEL-DTA2 automatically attempts the Fast Meter function when initially connected to an SEL relay. In some SEL relays, Fast Meter is supported automatically in a specific serial port. Other SEL relays have a port Automatic Message setting that needs to be set to DTA in order for the SEL-DTA2 to receive the Fast Meter messages. Refer to your relay instruction manual to get specific information about port settings and Fast Meter support.

If the SEL relay does not support Fast Meter, the SEL-DTA2 defaults to the standard meter function. Fast Meter data transfer allows for fast

confirmation of voltage and current quantities during substation switching operations.

The SEL-DTA2 performs meter calculations instead of the relay during Fast Meter data transfer. The SEL-DTA2 uses a three-sample average and updates selected outputs every 0.5 second. A signal transition from zero to full scale will require three Fast Meter updates, or 1.5 seconds.

If the SEL-DTA2 has defaulted to the standard meter function, it automatically attempts the Fast Meter function every ten minutes.

You can manually initiate the Fast Meter function from the SEL-DTA2 by entering the **SET** command. The SEL-DTA2 will initiate the Fast Meter request once the settings have been accepted, with or without a setting change. See *Command Descriptions on page 3.4 in Section 3: Communications* for information on the **SET** command.

You can confirm the Fast Meter function by observing the meter display updating time.

Status

There are two ways to enter the STATUS mode.

1. Press the front-panel **{STATUS}** pushbutton.
2. A relay status warning forces the SEL-DTA2 into STATUS mode.

When the **{STATUS}** pushbutton is pressed, the SEL-DTA2 checks the status of the relay and displays the received status message (see *Figure 2.7*). The **{SCROLL}** controls can be used to view any two lines of the message.

```
DATE: 01/04/90              Time: 08:50:30
OFFSET  IP = 0 mV
```

Figure 2.7 Relay Status Message

Upon automatic receipt of a relay status warning, the SEL-DTA2 enters the STATUS mode. The display shows `RELAY STATUS WARNING` in blinking characters above the message (see *Figure 2.8*). Pressing any operative front panel control acknowledges the condition, after which the STATUS mode functions as previously defined.

```
          RELAY STATUS WARNING
DATE: 01/04/90              Time: 08:50:30
```

Figure 2.8 Relay Status Warning Message

The SEL-DTA2 automatically exits the STATUS mode when it receives a fault report; press **{CLEAR}**, **{METER}**, or **{FAULTS}** to exit manually.

Standby

Press the front panel **{CLEAR}** pushbutton to enter the STANDBY mode; the following display message indicates STANDBY:

```
                SEL-DTA
            RELAY ID STRING
```

The SEL-DTA2 remains in this mode until:

- An active display mode is selected by pressing an operative front-panel pushbutton.
- The SEL-DTA2 receives a relay status message.
- The relay reports a fault to the SEL-DTA2.

In this mode, only the **{FAULTS}**, **{METER}**, **{STATUS}**, and **{CLEAR}** pushbuttons are operative.

The **{CLEAR}** pushbutton function depends on the current SEL-DTA2 mode. In any mode other than STANDBY, pressing **{CLEAR}** changes the mode to STANDBY. If the SEL-DTA2 is already in STANDBY mode, the following operations occur:

1. The display module is tested for proper operation; if this test fails, an automatic SEL-DTA2 status message is sent to SEL-DTA2 serial Port 1.
2. With **{CLEAR}** asserted, all elements of the display are actuated, allowing visual verification of proper display operation.
3. Upon release, the display clears and the SEL-DTA2 returns to STANDBY mode.

Rear Panel Connections and Configurations

All connections to the SEL-DTA2 are made on the rear panel, *Figure 5.1*.

Isolator Input

The SEL-DTA2 has one programmable isolator input for control of transducer and contact output data from a remote system.

ISO1, the RESET input, clears any analog channels set to indicate fault location and contact outputs A1–A5. After the output quantities are cleared, the RST ACK contact output (A6) is closed and remains closed for as long as RESET is asserted. This input is rising-edge sensitive.

Communications Ports

The SEL-DTA2 has two EIA-232 communications ports, labeled Port 1 and Port 2. Connect Port 1 to a personal computer. It is used for changing the analog output scaling and other settings. Connect Port 2 to the relay port designated automatic for communications with the relay. See *Table 3.1*. See *Table 4.1* for a list of cables that connect to Port 1 and Port 2.

Transducer Outputs

The SEL-DTA2 is equipped with eight programmable transducer channels. Each of these is available from the rear panel in voltage (–5 to +5 V) and current (–1 to 1 mA or –5 to 5 mA) form. The instrument also provides a separate return to ground for each channel. These signals are presented at the rear panel through a female 25-pin "D" connector, labeled "Analog".

For systems requiring screw terminal connections, an optional adapter board is available, *Figure 2.9*, which breaks a female 25-pin "D" connector out into screw terminals. *Table 2.1* shows the pin assignments. See *Table 4.1* for the cable that connects the analog port to the terminal block adapter.

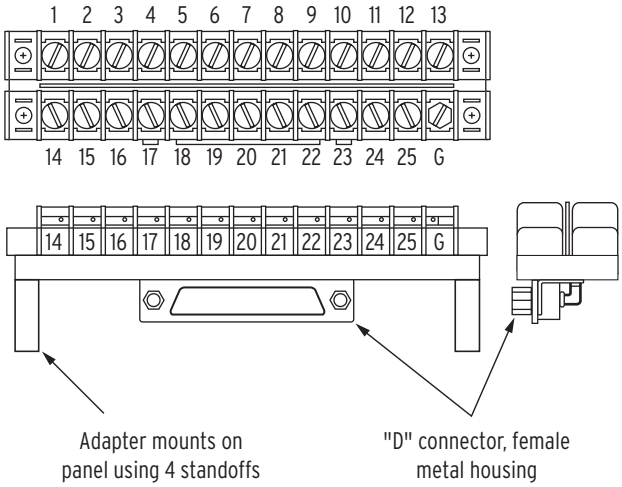

Figure 2.9 DB-25 to Terminal Block Adapter

Table 2.1 Adapter Board Signal Assignments

Signal Description	Pin
Voltage output 1	13
Ground 1	25
Current output 1	12
Voltage output 2	11
Ground 2	24
Current output 2	10
Voltage output 3	9
Ground 3	23
Current output 3	8
Voltage output 4	7
Ground 4	22
Current output 4	6
Voltage output 5	5
Ground 5	21
Current output 5	4
Voltage output 6	3
Ground 6	20
Current output 6	2
Voltage output 7	1
Ground 7	19
Current output 7	14
Voltage output 8	15
Ground 8	18
Current output 8	16

Each output channel is independently programmable with output quantity (Vab, Ia, Fault Location, etc.) and range.

Contact Outputs

The rear panel has six relay contact outputs (A1–A6). These outputs indicate fault conditions and acknowledge reset commands. An additional relay contact indicates self-test failure or other alarm conditions. All contact outputs are dedicated and not programmable. *Table 2.2* shows contact assignments and signal descriptions.

Table 2.2 Contact Assignments and Signal Descriptions

Terminal Block	Terminal Block Positions	Standard Contact Arrangement[a]	Signal	Description
POWER	1,2,3	N/A	+,–,GND	AC/DC power to unit.
IS01	4,5	N/A	RESET	Clears analog channels indicating fault location, and clears contacts A1–A5.
A1	6,7	a	A	The current fault involves Phase A.
A2	8,9	a	B	The current fault involves Phase B.
A3	10,11	a	C	The current fault involves Phase C.
A4	12,13	a	G	The current fault involves ground.
A5	14,15	a	FAULT	A fault has occurred.
A6	16,17	a	RST ACK	All fault-related analog and contact outputs are reset.
ALARM	18,19	b	ALARM	An alarm condition exists.

[a] Shown in the de-energized state. You can order these contacts from the factory with either an "a" or "b" configuration.

Relay contacts A1–A5 reflect new fault information. A1–A4 indicate the involved phases; A5 indicates that at least one phase is involved. A1–A5 deassert in response to either of two conditions:

1. Assertion of the RESET isolator input clears A1–A5 immediately and asserts the RST ACK output. The RST ACK signal is valuable for interfacing to RTUs and other instruments requiring verification of proper device operation.
2. If, after a settable interval (RESET), the instrument detects no RESET input assertion, A1–A5 reset automatically.

A settable time interval (LOCK) controls update of contact outputs A1–A5 and any analog outputs dedicated to fault location. During LOCK cycles after a fault, outputs are not affected by subsequent faults. This feature can be used to avoid replacing accurate fault information with less accurate data (this may occur during reclosing operations).

The RST ACK output is tied to the RESET isolator input. When RESET is asserted, RST ACK asserts until a fault occurs.

Self-Tests

The SEL-DTA2 runs an assortment of self-tests to ensure reliable operation. This section describes each test and the steps taken if a test fails. The instrument generates a report after any change in self-test status. All self-tests are run on power-up and after use of the setting procedure. During normal operation, all self-tests except the display test run every few minutes.

Random-Access Memory

The instrument periodically checks random-access memory (RAM). If a byte cannot be written to and read from, the SEL-DTA2 declares a RAM failure. It transmits a STATUS message with the socket designation of the affected RAM IC to serial Port 1. There is no warning state for this test.

Read-Only Memory

The SEL-DTA2 checks read-only memory (ROM) by computing a checksum. If the computed value does not agree with the stored value, the instrument declares a ROM failure and transmits a STATUS message to serial Port 1. There is no warning state for this test.

Settings

Two images of the system settings are stored in nonvolatile memory. The SEL-DTA2 compares them after initial commissioning and periodically thereafter. If the images ever disagree, the setting test fails and the instrument transmits a STATUS message to serial Port 1. There is no warning state for this test.

Display

The display module is tested when the instrument is powered up, and as described in the STANDBY display mode description. If a display module failure is detected, the SEL-DTA2 sends an automatic status message to serial Port 1.

This page intentionally left blank

Section 3
Communications

Introduction

The SEL-DTA2 is set via serial communications Port 1, connected to a personal computer. Communications serve the following purposes:

1. The SEL-DTA2 receives display and transducer configurations.
2. The SEL-DTA2 responds, by message, to changes in system self-test status.
3. The SEL-DTA2 responds to commands for setting the clock and requests for instrument status information.

Two access levels and passwords protect against unauthorized access.

Serial Port Connections and Configurations

Two serial port connectors on the SEL-DTA2 rear panel are labeled Port 1 and Port 2. Both adhere to EIA-232 data communications standards.

Port 1 is intended for local communications via a personal computer, printing terminal, or other device.

Port 2 of the SEL-DTA2 should be connected to a relay port set for automatic message or DTA support.

The port baud rates are set with jumpers accessed by removing the top cover. Available rates are 300, 600, 1200, 2400, 4800, and 9600. SEL-DTA2 baud rates must match those set for the relay.

NOTE: Do not set the SEL-DTA2 baud rate higher than 2400 bps when connected to an SEL-300 series relay.

The maximum effective data processing rate for the SEL-DTA2 when connected to an SEL-300 series relay is 2400 bps. Setting a higher data rate results in loss of communication data and may cause the SEL-DTA2 to halt all communication.

The serial data format is:

8 data bits
2 stop bits (SEL-DTA2 Firmware Revisions: 100–400)

or

1 stop bit (SEL-DTA2 Firmware Revisions: 500–800)
No parity

This format cannot be altered. *Table 3.1* shows serial port pin assignments and signal definitions. Refer to *Command Characteristics on page 3.3* to see details of the **VERSION** command and a method to determine the firmware revision of your SEL-DTA2.

Table 4.1 lists cables that connect to Port 1 and Port 2.

Table 3.1 Serial Port Pin Assignments

Connector Pin	Signal	Description
1	+5 Vdc	+5 volt output (enable with JMP 3, see *Figure 4.2*).
2	RXD	Receive data input.
3	TXD	Transmit data output.
4	+12 Vdc	+12 volt output (enable with JMP 2, see *Figure 4.2*).
5	GND	Ground.
6	–12 Vdc	–12 volt output (enable with JMP 1, see *Figure 4.2*).
7	RTS	The SEL-DTA2 asserts this line under normal conditions. When its received-data buffer is full, the line deasserts until the buffer has room to receive more data. Connected devices should monitor RTS (usually with their CTS input) and stop transmitting characters whenever the line deasserts. If transmission continues, data may be lost.
8	CTS	The SEL-DTA2 monitors CTS and transmits characters only when CTS is asserted.
9	GND	Ground.

Communications Protocol

The communications protocol consists of hardware and software attributes. Hardware protocol includes the control line functions described above. The following software protocol is designed for manual and automatic communications.

1. All commands received by the SEL-DTA2 must be of the form:

   <command><Enter> or **<command><CR><LF>**

   Thus, a command transmitted to the SEL-DTA2 should consist of the command followed by a carriage return or carriage return and line feed. You may truncate commands to the first three characters. Upper- and lowercase characters may be used without distinction, except in passwords.

2. The SEL-DTA2 transmits all messages in the following format:

   <MESSAGE LINE 1><CR><LF>

   <MESSAGE LINE 2><CR><LF>

   •
   •
   •

   <LAST MESSAGE LINE><CR><LF>

   Each line of the message ends with a carriage return and line feed.

3. The SEL-DTA2 indicates the volume of data in its received-data buffer through an XON/XOFF protocol.

   When the buffer drops below 1/4 full, the SEL-DTA2 transmits XON (ASCII hex 11) and asserts the RTS output.

   The SEL-DTA2 transmits XOFF (ASCII hex 13) when the buffer fills over 3/4 full. It deasserts the RTS output when the buffer is 95% full. Transmission sources should monitor for the XOFF character so they do not overwrite the input buffer. Transmission should terminate at the end of the message in progress when the transmission source receives XOFF and may resume when the SEL-DTA2 sends XON.

4. An XON/XOFF procedure can be used to control the SEL-DTA2 during data transmission. When the instrument receives XOFF during transmission, it pauses until it receives an XON. If there is no message in progress when the SEL-DTA2 receives XOFF, it blocks transmission of any message presented to its buffer. Messages are accepted after XON is received.

   The CAN character (ASCII hex 18) cancels a pending transmission. This is useful in terminating an unwanted transmission.

5. Control characters can be sent from most keyboards with the following keystrokes:

   XON : **<Ctrl+Q>** (hold down the Control key and press **Q**)
   XOFF : **<Ctrl+S>** (hold down the Control key and press **S**)
   CAN : **<Ctrl+X>** (hold down the Control key and press **X**)

Command Characteristics

Access Levels

A multi-level password system provides security against unauthorized access. There are three access levels:

Access Level 0. On power-up the SEL-DTA2 is in Access Level 0 and honors only the **ACCESS** command, which moves to Access Level 1. The SEL-DTA2 responds `Invalid Command` or `Invalid Access Level` to any other entry.

Access Level 1. Allows access to only those commands listed under Access Level 1 in *Figure 3.1*.

Access Level 2. Allows access to **PASSWORD** and **SET** commands plus all commands at lower levels.

This access scheme allows you to give personnel access to only those functions they require. Each level has an associated screen prompt and password. *Figure 3.1* shows the access levels, passwords, prompts, commands available at each level, and commands that move you between access levels. The SEL-DTA2 and the connected relay must have identical passwords in order to retrieve data from the relay.

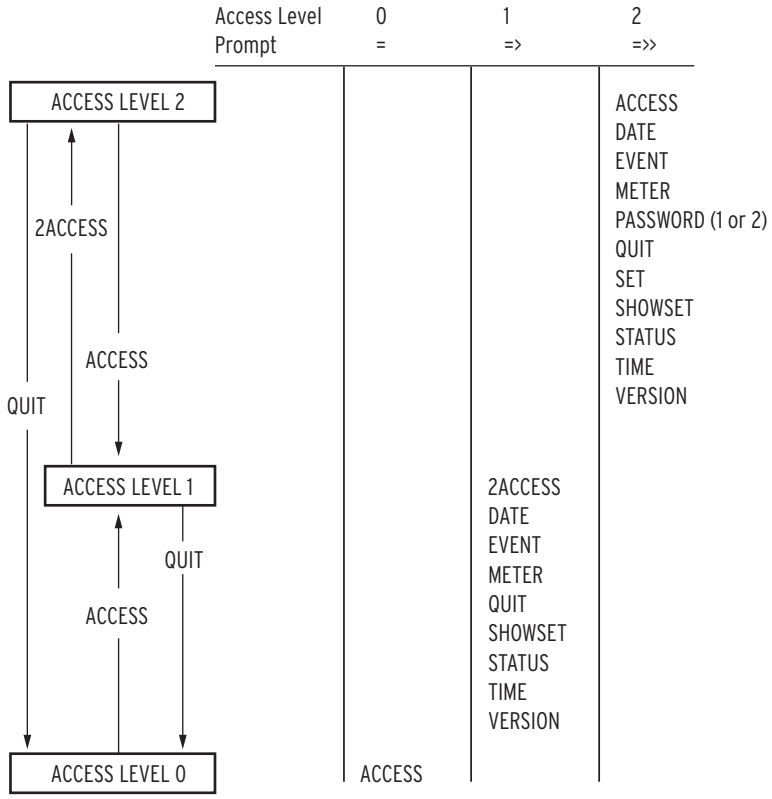

Figure 3.1 Access Level Relationships

Start-up

Immediately after power is applied, the instrument transmits the following message to communications Port 1:

```
SEL-DTA  Display/Transducer Adapter  Date: 1/1/91  Time: 01:01:01

SEL-DTA
=
```

Command Format

Commands consist of three or more characters; only the first three characters of any command are required. You may use upper- or lowercase characters without distinction, except in passwords.

Separate arguments from the command by spaces, commas, semicolons, colons, or slashes.

You may enter commands any time after receiving an appropriate prompt.

Command Descriptions

ACCESS (Access Level 0)

ACCESS allows you to enter Access Level 1 from the Access Level 0 = prompt. After you type **ACCESS <Enter>**, a prompt for the Access Level 1 password appears. Enter the password and press **<Enter>**. The Access Level 1 password is set to OTTER at the factory; use the Access Level 2 **PASSWORD** command to change passwords.

The following display indicates successful access:

```
=ACCESS <Enter>
Password: ? @@@@@@

SEL-DTA  Display/Transducer Adapter  Date: 1/1/91  Time: 01:02:30

Level 1

=>
```

The => prompt indicates Access Level 1.

2ACCESS (Access Level 1 or 2)

2ACCESS allows you to enter Access Level 2 from Access Level 1. After you type **2ACCESS <Enter>**, a prompt for the Access Level 2 password appears. Enter the second password and press **<Enter>**. The Access Level 2 password is set to TAIL at the factory; use the Access Level 2 **PASSWORD** command to change passwords.

The following display indicates successful access:

```
=>2ACCESS <Enter>
Password: ? @@@@@@

SEL-DTA  Display/Transducer Adapter  Date: 1/1/91  Time: 01:02:40

Level 2

=>>
```

The =>> prompt indicates Access Level 2; you may enter any command at this prompt.

DATE (Access Level 1 or 2)

DATE displays the date stored by the internal calendar/clock. Type **DATE <Enter>** to read the date; **DATE mm/dd/yy <Enter>** to enter a new date. Since the clock is synchronized with the relay clock approximately every five seconds, changing the date with this command is ineffective if the SEL-DTA2 is normally connected to a relay. This feature allows the SEL-DTA2 to benefit from the IRIG-B time code used by the target relay.

When the power is first turned on, the date is 1/1/91.

PASSWORD (1 or 2) (Access Level 2 Only)

To inspect the passwords, enter:

PASSWORD <Enter>

To change the password for Access Level 1 to BIKE enter:

PASSWORD 1 BIKE <Enter>

The SEL-DTA2 sets the password, pulses the ALARM relay closed, and transmits the response:

```
Set
```

NOTE: After entering new passwords, type **PASSWORD <Enter>** to inspect them. Make sure they are what you intended and record the new passwords. SEL-DTA2 passwords must match passwords set for the relay.

Passwords can be any length up to six numbers, letters, or any other printable characters except delimiters (space, comma, semicolon, colon, slash). It is important that you establish strong password protection to safeguard against unauthorized access. Strong passwords consist of six characters, with at least one special character or digit and mixed case sensitivity, but do not form a name, date, acronym, or word. Passwords formed in this manner are less susceptible to password guessing and automated attacks. Examples of valid, distinct strong passwords include:

Ot3579 A24.68 Ih2dcs 4u-Iwg Ic-4)=

If you lose passwords and are unable to gain access to the SEL-DTA2, you can temporarily disable password protection.

Step 1. Turn off the SEL-DTA2 and remove the cover.

Step 2. Disconnect the display cable from the display module and turn the unit back on.

Step 3. The SEL-DTA2 will disable password protection, allowing you to execute the **PASSWORD** command and display the current passwords.

WARNING: This device is shipped with default passwords. Default passwords should be changed to private passwords at installation. Failure to change each default password to a private password may allow unauthorized access. SEL shall not be responsible for any damage resulting from unauthorized access.

QUIT (Access Level 1)

QUIT command execution returns control to Access Level 1 from Access Level 1 or 2 and displays the instrument I.D., date, and time. Use this command when you finish communicating with the SEL-DTA2 to prevent unauthorized access. Note that control may return to Access Level 0 automatically after a settable interval of no activity (see TIME1 setting, SET command).

SET (Access Level 2 only)

The setting procedure requires you to answer prompting messages with new data or press **<Enter>** to indicate no change. When you have entered all data, the SEL-DTA2 displays the new settings and issues a prompt requesting approval to enable them. After you approve new settings, the SEL-DTA2 triggers the output reset, clearing the contact outputs and any analog outputs dedicated to fault location.

Error messages indicate when new entries are out of range or of the wrong type.

An example **SET** command display appears at the end of this section; settable parameters are defined as follows:

TIME1 controls the timeout interval of communications Port 1. This setting range is from 0 to 30 minutes. A setting of 0 disables Port 1 timeout.

LOCK specifies the time after a fault during which analog and contact output changes are suppressed for outputs dedicated to fault location. If, for example, a fault was immediately followed by two reclose faults within three seconds, only the first fault would affect the analog and contact outputs (using the example LOCK setting of 300 cycles).

RESET specifies the length of time after a fault before analog and contact outputs dedicated to fault location are automatically reset. The example setting requires the SEL-DTA2 to wait for two minutes before resetting the outputs. The character “0” specifies no automatic reset.

Settings MINW and MAXW specify the fault location window. Faults with locations outside this window are ignored by the SEL-DTA2. Using the example settings, a fault with a location of 75.34 miles would be captured, stored, displayed, and presented at the contact and analog outputs. A reverse fault with a location of –34.45 miles would not be processed by the SEL-DTA2; no outputs would be affected.

Settings QUA1–QUA8 control the type of data appearing at the transducer outputs. Available quantities are shown below:

- Currents: IA, IB, IC, IAB, IBC, ICA, 3I2, IR
- Voltages: VA, VB, VC, VAB, VBC, VCA, 3V2, 3V0, (SEL-221F/121F) VS

- Single-Phase Power
  - PA, PB, PC (real), available only with Fast Meter
  - QA, QB, QC (reactive), available only with Fast Meter
- Three-Phase Power: P (real), Q (reactive)

Refer to your relay instruction manual to determine if the following demand and peak demand values are available.

Demand. DA, DB, DC, DR, D3I2, DP, DQ

Peak Demand. PDA, PDB, PDC, PDR, PD3I2, PDP, PDQ

Fault Location. FL

In the example setting, QUA1 is set to "VAB," indicating that Transducer Channel 1 reflects the voltage measured from Phase A to Phase B.

Settings MIN1–MIN8 and MAX1–MAX8 reflect the measured quantities corresponding to –5 V (–1 mA or–5 mA) and 5 V (1 mA or 5 mA), respectively. Values within the set range for a channel are scaled according to these equations (where n is 1–8):

$$\text{Vout} = \frac{(\text{Measured Quantity} - \text{MINn}) \bullet 10\ \text{V}}{\text{MAXn} - \text{MINn}} - 5\ \text{V} \qquad \text{Option 1 or 5}$$

$$\text{Iout} = \frac{(\text{Measured Quantity} - \text{MINn}) \bullet 2\ \text{mA}}{\text{MAXn} - \text{MINn}} - 1\ \text{mA} \qquad \text{Option 1}$$

$$\text{Iout} = \frac{(\text{Measured Quantity} - \text{MINn}) \bullet 10\ \text{mA}}{\text{MAXn} - \text{MIN}}\text{n} - 5\ \text{mA} \qquad \text{Option 5}$$

Using the example settings and a measured value VAB of 231.2 kV, the output quantities for Analog Channel 1 (with Option 1) would be:

$$\text{Vout} = \frac{(231.2 - (-250.0)) \bullet 10\ \text{V}}{250.0 - (-250.0)} - 5\text{V} \qquad \text{Option 1 or 5}$$

$$= 4.62\text{V}$$

$$\text{Iout} = \frac{(231.2 - (-250.0)) \bullet 2\ \text{mA}}{\text{MAX1} - \text{MIN1}} - 1\text{mA} \qquad \text{Option 1}$$

$$= 0.92\ \text{mA}$$

NOTE: To represent quantities having both positive and negative values (i.e., VARs and Watts) such that negative values give negative analog outputs and positive values give positive analog outputs, MIN and MAX must be symmetrical around zero (e.g., MIN = —200 MW and MAX = +200 MW).

SET command display:

```
=>>SET

SET clears events, CTRL X cancels.                                  PERMISSIBLE RANGE
ID      :   SEL-DTA  Display/Transducer Adapter                     <lower,upper;step>
 ?
TIME1   :   Port 1 timeout (min)    = 0                 ?          <0,30;1>
LOCK    :   Output lockout (cyc)    = 300.0             ?          <0,8000;0.25>
RESET   :   Output timeout (sec)    = 120               ?          <0,600;1>
MINW    :   Min Fault Window        = -10.0             ?          <-100000,100000>
MAXW    :   Max Fault Window        = 100.0             ?          <-100000,100000>
QUA1    :   Measured quantity       = VAB               ?          <IA,...,FL>
MIN1    :   Min Range               = -250.0            ?          <-100000,100000>
MAX1    :   Max Range               = 250.0             ?          <-100000,100000>
QUA2    :   Measured quantity       = IA                ?          <IA,...,FL>
MIN2    :   Min Range               = 0.0               ?          <-100000,100000>
MAX2    :   Max Range               = 1200.0            ?          <-100000,100000>
QUA3    :   Measured quantity       = IB                ?          <IA,...,FL>
MIN3    :   Min Range               = 0.0               ?          <-100000,100000>
MAX3    :   Max Range               = 1200.0            ?          <-100000,100000>
QUA4    :   Measured quantity       = IC                ?          <IA,...,FL>
MIN4    :   Min Range               = 0.0               ?          <-100000,100000>
MAX4    :   Max Range               = 1200.0            ?          <-100000,100000>
QUA5    :   Measured quantity       = VA                ?          <IA,...,FL>
MIN5    :   Min Range               = -150.0            ?          <-100000,100000>
MAX5    :   Max Range               = 150.0             ?          <-100000,100000>
QUA6    :   Measured quantity       = P                 ?          <IA,...,FL>
MIN6    :   Min Range               = -200.0            ?          <-100000,100000>
MAX6    :   Max Range               = 200.0             ?          <-100000,100000>
QUA7    :   Measured quantity       = Q                 ?          <IA,...,FL>
MIN7    :   Min Range               = -200.0            ?          <-100000,100000>
MAX7    :   Max Range               = 200.0             ?          <-100000,100000>
QUA8    :   Measured quantity       = FL                ?          <IA,...,FL>
MIN8    :   Min Range               = -100.0            ?          <-100000,100000>
MAX8    :   Max Range               = 100.0             ?          <-100000,100000>

New settings:


ID  =SEL-DTA  Display/Transducer Adapter

TIME1=0
LOCK =300.0RESET=120
MINW =-10.0MAXW =100.0
QUA1 =VABMIN1 =-250.0MAX1 =250.0
QUA2 =IAMIN2 =0.0MAX2 =1200.0
QUA3 =IBMIN3 =0.0MAX3 =1200.0
QUA4 =ICMIN4 =0.0MAX4 =1200.0
QUA5 =VAMIN5 =-150.0MAX5 =150.0
QUA6 =P MIN6 =-200.0MAX6 =200.0
QUA7 =Q MIN7 =-200.0MAX7 =200.0
QUA8 =FLMIN8 =-100.0MAX8 =100.0

OK (Y/N) ? Y
```

SHOWSET (Access Level 1 or 2)

Enter **SHOWSET** to inspect the SEL-DTA2 settings. The display shows the current settings. You cannot modify settings with this command; setting entry is accomplished with the **SET** command in Access Level 2.

SHOWSET output example:

```
ID   =SEL-DTA  Display/Transducer Adapter
TIME1=0
LOCK =300.0  RESET=120
MINW =-10.0  MAXW =100.0
QUA1 =VAB    MIN1 =-250    MAX1 =250.0
QUA2 =IA     MIN2 =0.0     MAX2 =1200.0
QUA3 =IB     MIN3 =0.0     MAX3 =1200.0
QUA4 =IC     MIN4 =0.0     MAX4 =1200.0
QUA5 =VA     MIN5 =-150.0  MAX5 =150.0
QUA6 =P      MIN6 =-200.0  MAX6 =200.0
QUA7 =Q      MIN7 =-200.0  MAX7 =200.0
QUA8 =FL     MIN8 =-100.0  MAX8 =100.0
```

The **SET** command description includes a detailed explanation of the SEL-DTA2 settings.

STATUS (Access Level 1 or 2)

SEL-DTA2 self-test status can be examined with the **STATUS** command. The instrument also automatically executes the **STATUS** command whenever a self-test indicates a warning or failure condition. The instrument sends output to communications Port 1.

STATUS report format:

```
SEL-DTA Display/Transducer Adapter  Date: 1/1/91  Time: 01:10:23

SELF TESTS

RAM  ROM  SET  DISPLAY
OK   OK   OK   OK
```

The status of four tests is reported in the last two rows of the report. If a RAM, ROM, or settings (EEPROM) test fails, the IC socket number of the defective part is indicated. A display failure is indicated in the last column.

TIME (Access Level 1 or 2)

To read the internal clock, type **TIME <Enter>**. To set the clock, type **TIME** followed by the desired setting. Separate the hours, minutes, and seconds with colons, semicolons, spaces, or slashes. To set the clock to 23:30:00, enter:

TIME 23 30 00 <Enter> or **TIME 23:30:00 <Enter>**, etc.

A quartz crystal oscillator provides the time base for the internal clock.

Since the SEL-DTA2 clock synchronizes with the relay clock approximately every five seconds, changing the time with this command is ineffective if the SEL-DTA2 is normally connected to a relay. This feature allows the SEL-DTA2 to benefit from the IRIG-B time code used by the relay.

VERSION (Access Level 1 or 2)

Executing the **VERSION** command returns the FID string to the computer terminal screen. Use this command to verify which version of firmware is in the SEL-DTA2 chassis. See *Appendix A: Firmware Versions and Relay Compatibility* for a definition of firmware covered by this release of the manual. The following is an FID number with the Part/Revision number in bold:

FID=**SEL-DTA-R207**-V22-D921109

This page intentionally left blank

Section 4
Installation

Installing the DTA2

Mounting

The SEL-DTA2 is designed for mounting by its front vertical flanges in a 19" vertical relay rack. It may also be mounted semi-flush in a switchboard panel. Use four #10 screws for mounting. See *Figure 4.1* for a mounting and drill plan.

Interface Cables

Table 4.1 lists cables that interface the DTA2 to other devices.

Table 4.1 DTA2 Interface Cables

DTA2	External Device	Connector on Cable	SEL Cable No.
Port 1	DTE[a]	25-pin Male	C223A
Port 1	DTE[a]	25-pin Female	C227A
Port 1	DTE[a]	9-pin Female	C234A
Port 1	PRTU	9-pin CON-X-ALL	C231
Port 2	200/300 Series Relays	9-pin Male	C272A
Port 2	100 Series Relays	9-pin CON-X-ALL	C372A
Analog	Terminal Block Adapter	25-pin Male	C701

[a] Data Terminal Equipment (computer, terminal, printer, etc.)

Power Connections

Connect appropriate dc voltage to terminals 1 (+) and 2 (–) on the back panel. Connect ground to terminal 3 (GND - ground).

The 48/125V and 125/250V power supplies can operate from either ac or dc voltage and connection polarity is not important.

See *Figure 5.1* for terminal locations. *Table 2.2* shows terminal numbering.

Communications Circuits

Connections to the two EIA-232 serial communications ports are made via two 9-pin connectors labeled Port 1 and Port 2 on the rear panel.

NOTE: Ground pins on connectors should not be relied upon for safety grounding.

Low-energy, low-voltage MOVs and passive RC filters protect the communications circuits. Minimize communications-circuit difficulties by keeping the length of the EIA-232 cables as short as possible. Cable length should never exceed 100 feet. Use shielded communications cable for lengths greater than ten feet.

Jumper Selection

Figure 4.2 provides the location and configuration information for all jumpers. They are easily accessed by removing the top cover.

Baud Rate

CAUTION: Do not install two baud rate jumpers for the same port. This can damage the baud rate generator.

J6 provides EIA-232 baud rate selection. To select a baud rate for a particular port, place the jumper so it connects the pin labeled with the desired port to a pin labeled with the desired baud rate. Available baud rates are 300, 600, 1200, 2400, 4800, and 9600. Baud rate settings for the SEL-DTA2 must match those set for the associated relay.

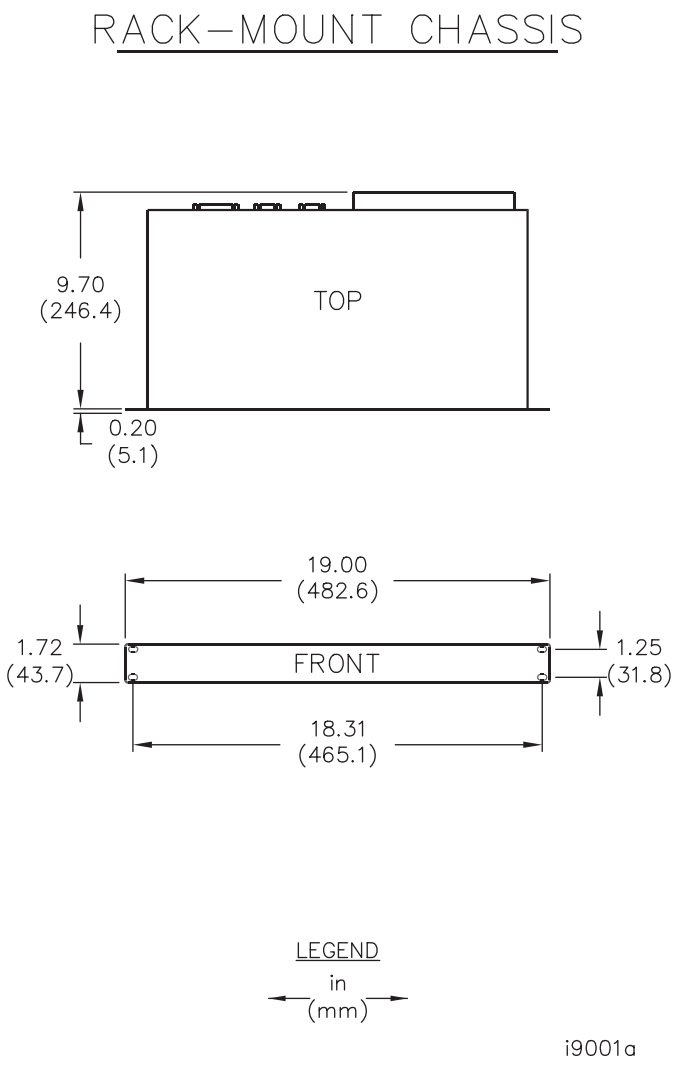

Figure 4.1 SEL-DTA2 Dimensions, Panel Cutout, and Drill Plan

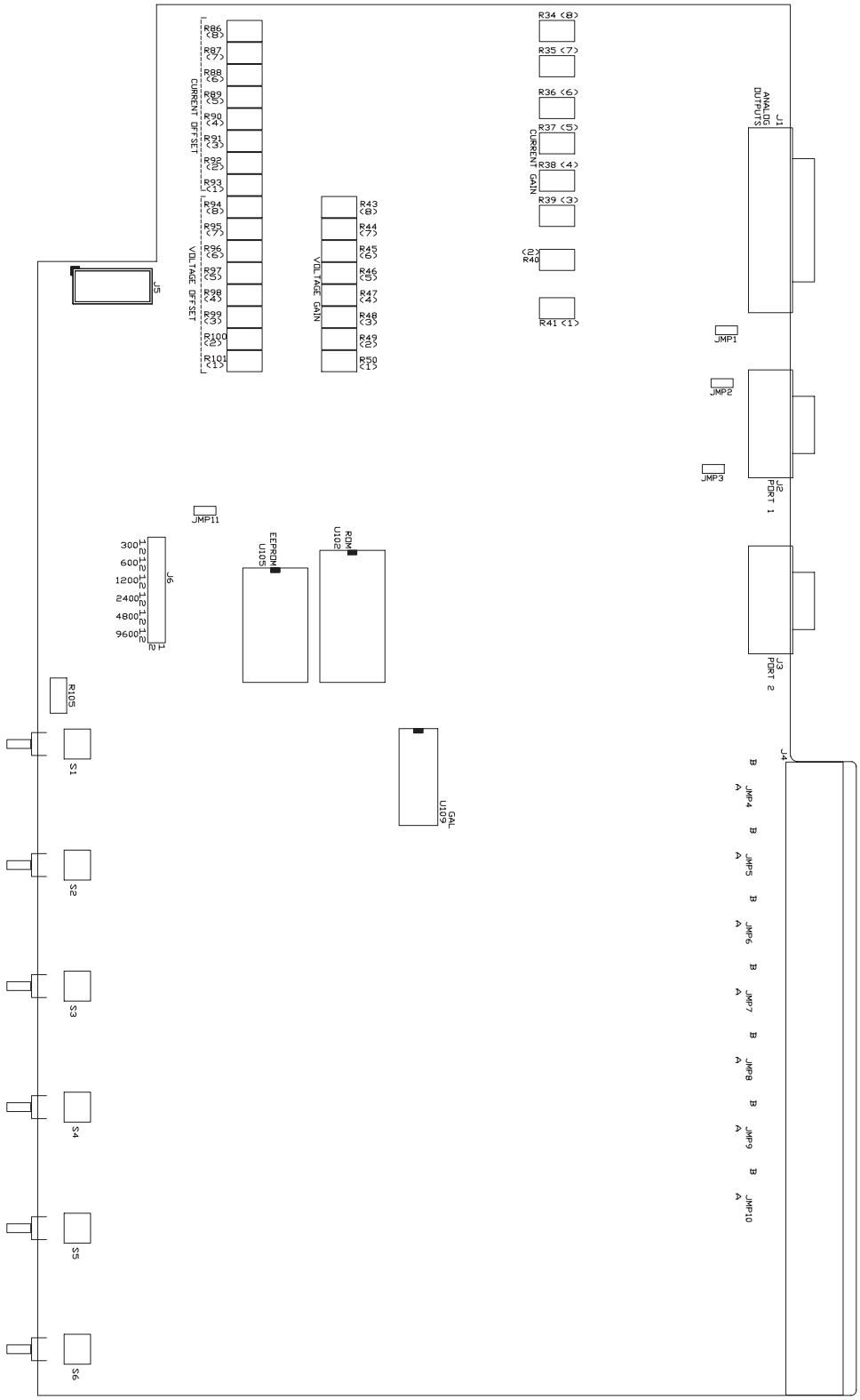

Figure 4.2 SEL-DTA2 Parts Placement Diagram

This page intentionally left blank

Section 5
Maintenance and Testing

Introduction

This section provides procedures for initial checkout, calibration, and troubleshooting of the SEL-DTA2.

Initial Checkout

The initial checkout of the SEL-DTA2 should familiarize you with the instrument and ensure that all functions are operational.

Equipment Required

The following equipment is necessary for initial checkout of the SEL-DTA2:

- Personal computer with EIA-232 serial communications interface.
- Cable configured for interconnection of SEL-DTA2 and terminal.
- Cable configured for interconnection of SEL-DTA2 and SEL relay.
- Meter capable of measuring currents in the range –5 to 5 mA and voltages in the range –5 to 5 V.
- An SEL digital relay.
- Source of three-phase voltages and at least two currents.

Front and Rear Panels

Refer to *Figure 5.1* for front-panel controls and displays and rear-panel connections used in the procedures in this section. *Table 2.2* shows terminal numbering.

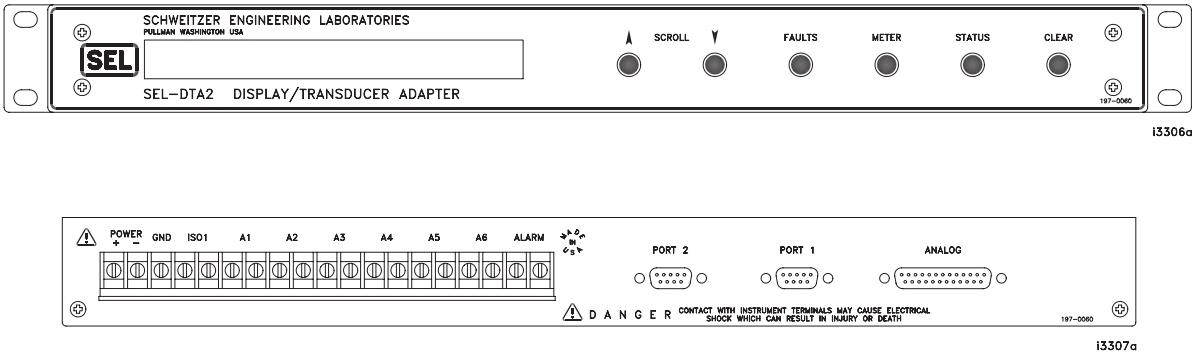

Figure 5.1 SEL-DTA2 Front and Rear Panels

Checkout Procedure

Manual Conventions

In this manual, commands to type appear in bold/uppercase: **VERSION**. Keys to press appear in bold/brackets: **<Enter>**.

SEL-DTA2 output appears in the following format:

```
DATE: 01/01/90                Time:01:01:32
OFFSET  IP = 0 mV
```

The following information should allow you to complete the checkout procedure without referring to detailed command descriptions. If you need additional information, *Section 3: Communications* provides a full explanation of all commands. *Section 4: Installation* includes additional information on port configurations. These instructions assume familiarity with the target SEL relay; the reader is referred to relay documentation for information regarding relay operations and configurations.

Step 1. Inspect the instrument for physical damage such as dents or rattles.

Step 2. Connect a computer to Port 1 on the rear panel of the SEL-DTA2. Be sure your serial port configuration is compatible. *Section 3: Communications* provides additional information on port configurations. *Section 4: Installation* includes information on baud rate selection.

Step 3. With the SEL-DTA2 disconnected from the relay, turn on the target relay and set the relay Access Level 1 and 2 passwords to the SEL factory default passwords.

Step 4. Turn the target relay off. Connect the target relay to Port 2 on the rear panel of the SEL-DTA2. Make sure the relay port baud rate setting is 2400 bps and the remaining port settings are compatible with SEL-DTA2 communication. Refer to your relay instruction manual for details.

Step 5. Turn on the relay and SEL-DTA2 power. The relay enables in its usual manner, and the terminal displays the following message:

```
SEL-DTA Display/Transducer Adapter Date: 1/1/91 Time: 01:01:01

SEL-DTA
=
```

The SEL-DTA2 display shows:

```
      PLEASE WAIT: ACCESSING RELAY
```

When the SEL-DTA2 gains access to the relay, it replaces the previous message with the following:

```
                SEL-DTA
            RELAY ID STRING
```

Failure to access the relay within a couple of minutes indicates a failure in the communications channel between the relay and the SEL-DTA2. If the relay/ SEL-DTA2 system did not power-up properly, see *Troubleshooting on page 5.5*.

The = prompt preceding the cursor on the computer terminal program indicates that communications with the SEL-DTA2

are at Access Level 0, the lowest of the three access levels. The only command accepted at this level is **ACCESS**, which opens communications to Access Level 1.

Step 6. Enter the command **ACCESS** and press **<Enter>**. At the password prompt, enter the Access Level 1 password and press **<Enter>**. The => prompt appears, indicating that you have established communications at Access Level 1.

Step 7. Press the **{CLEAR}** pushbutton on the front panel. The display turns black while the pushbutton is asserted and shows the following message when the pushbutton is released.

```
SEL-DTA
RELAY ID STRING
```

Step 8. Press the **{STATUS}** pushbutton on the front panel. The display shows:

```
Executing STATUS Request
Please Wait
```

for up to 60 seconds while it retrieves status information from the relay. The first two lines of acquired status data appear on the display:

```
DATE: 01/01/90                Time:01:01:32
OFFSET  IP = 0 mV
```

Use the **{SCROLL}** pushbuttons to view all lines of status data. Holding a **{SCROLL}** pushbutton in automatically repeats the control.

If the SEL-DTA2 is unable to retrieve the information before the 60-second timeout, the following message appears on the display (data timeout):

```
PLEASE WAIT: ACCESSING RELAY
```

This indicates a communication failure between the relay and SEL-DTA2. Refer to *Troubleshooting on page 5.5* for suggested actions.

Step 9. Press the **{METER}** pushbutton on the front panel1twice. The display shows:

```
PLEASE WAIT
```

for up to 60 seconds while the SEL-DTA2 retrieves meter data from the relay.

Since the test source has not yet been connected to the relay, displayed data resembles the following:

```
MET IA=1          B=2          C=0
     P=0.00       Q=0.00
```

The timeout response is identical to that of the **{STATUS}** pushbutton; refer to *Troubleshooting on page 5.5* if a data timeout occurs.

Step 10. Press the **{FAULTS}** pushbutton. Since no faults have yet been reported to the SEL-DTA2 by the relay, the instrument displays the following message:

```
          FAULT HISTORY EMPTY
   P=0.00      Q=0.00
```

When the pushbutton is released, the display reverts to its original status.

Step 11. The SEL-DTA2 is shipped with demonstration settings; inspect these with the **SHOWSET** command. Type **SHOWSET <Enter>** to display the settings:

```
=>SHOWSET

ID  =SEL-DTA Display/Transducer Adapter
TIME1=0
LOCK =300.0   RESET=120
MINW =-10.0   MAXW =100.0
QUA1 =VAB     MIN1 =-250    MAX1 =500.0
QUA2 =IA      MIN2 =0.0     MAX2 =1200.0
QUA3 =IB      MIN3 =0.0     MAX3 =1200.0
QUA4 =IC      MIN4 =0.0     MAX4 =1200.0
QUA5 =P       MIN5 =0.0     MAX5 =-200.0
QUA6 =P       MIN6 =0.0     MAX6 =200.0
QUA7 =Q       MIN7 =-200.0  MAX7 =200.0
QUA8 =FL      MIN8 =0.0     MAX8 =100.0
```

The **SHOWSET** command description includes a detailed explanation of SEL-DTA2 settings. Briefly, the first line shows the SEL-DTA2 identification string; the second shows the timeout for Port 1. The third line shows the contact and analog output fault lockout period and automatic reset timeout, while the fourth indicates the fault window settings. The remaining lines contain measured quantity and scaling information for the eight analog output channels.

Step 12. Turn the relay power off and connect a source of three-phase voltages and currents to the relay inputs. Set up a typical set of test currents and voltages at the test source outputs.

Step 13. Turn the relay power back on.

Step 14. Press the **{METER}** pushbutton and verify correspondence of displayed data and test quantities. Using an ammeter and voltmeter, make sure the currents and voltages delivered to the analog outputs agree with displayed data. Refer to *Section 1: Introduction* for pin configuration information and output quantity equations.

Step 15. Set up test quantities corresponding to a forward fault. Shortly after the relay elements respond to the fault condition, the display shows a message of the following format:

```
              NEW FAULT
 01  01/02/90 22:33:51.812   1BG   74.54
```

The contents of the second line vary according to test quantities. Faults outside the set fault window are not displayed or maintained in the fault history.

Step 16. Change the relay and SEL-DTA2 passwords to strong private passwords. Cycle power on the relay and SEL-DTA2 to re-establish communication.

This checkout procedure demonstrates only a few of the SEL-DTA2 features. Study *Section 3: Communications* for a complete understanding of this instrument's capabilities.

Removing Cover

Step 1. Remove power source by disconnecting SEL-DTA2.

Step 2. Remove seven screws from top of cabinet.

Step 3. Remove two screws from rear panel.

Step 4. Remove cover by sliding to the rear.

Calibration

The SEL-DTA2 is factory calibrated to a very high degree of accuracy. If you suspect that the unit is out of calibration, please contact the factory. We can provide instructions for returning the unit for factory recalibration.

Troubleshooting

Inspection Procedure

Complete the following inspection procedure before disturbing the system. After you finish the inspection, proceed to the Troubleshooting Table.

Step 1. Check to see that power to the SEL-DTA2 and target relay is on.

Step 2. Inspect the cabling to the SEL-DTA2 serial communications ports. Be sure the relay is connected to Port 2 and a communications device is connected to Port 1.

Troubleshooting Table

Garbled or Nonexistent Display Data

Step 1. Power is off.

- ➢ Blown fuse in SEL-DTA2
- ➢ SEL-DTA2 input power is not present

Step 2. Loose or disconnected internal ribbon cable to display module.

Step 3. Display contrast incorrectly adjusted.

Step 4. SEL-DTA2 display module or main board failure.

System Does Not Respond to Commands

Step 1. Communications device not connected to system.

Step 2. SEL-DTA2 or communications device at incorrect baud rate or other communication parameter incompatibility (parity, word length, cabling error, etc.).

Step 3. System is attempting to transmit information, but cannot due to handshake conflict. Check communications cabling.

Step 4. System is in the XOFF state, halting communications. Type **<Ctrl+Q>** to put system in XON state.

No Prompting Message Issued to Terminal Upon Power-Up

Step 1. Terminal not connected to SEL-DTA2 Port 1.

Step 2. Wrong baud rate.

Step 3. Improper connection of terminal to system.

Step 4. Port 1 timeout interval set to a value other than zero.

Step 5. SEL-DTA2 main board failure.

SEL-DTA2 Fails to Gain Access to Relay

Step 1. Relay baud rate does not agree with SEL-DTA2 baud rate.

Step 2. SEL-DTA2 passwords not identical to relay passwords.

System Does Not Display Faults

Step 1. SEL-DTA2 connected to relay port which is not designated automatic (relay may be equipped with old software which does not support multiple automatic message ports).

Step 2. Relay baud rate does not agree with SEL-DTA2 baud rate.

Step 3. Improper connection of SEL-DTA2 to relay.

Terminal Displays Meaningless Characters

Step 1. Incorrect baud rate setting.

Step 2. Check terminal configuration. See *Section 3: Communications*.

Self-Test Failure: ROM

Step 1. EPROM failure. Replace EPROM.

Self-Test Failure: RAM

Step 1. Failure of static RAM IC. Replace RAM.

Self-Test Failure: SET

Step 1. EEPROM failure. Replace EEPROM.

Self-Test Failure: Display

Step 1. Loose or disconnected display module cable.

Step 2. Display module failure.

At Power-Up, Display Stays Darkened

Step 1. SEL-DTA2 automatic message port (Port 1) is in the XOFF state. Connect a terminal to Port 1 and issue **<Ctrl+Q>** to enter the XON state.

Appendix A
Firmware Versions and Relay Compatibility

Firmware Versions

This manual covers any SEL-DTA2 Display/Transducer Adapters that contain firmware bearing the most recent part numbers and revision numbers listed at the top of *Table A.1*.

Table A.1 Firmware Versions

Firmware Part/Revision No.	Description of Firmware
	This firmware differs from the previous version as follows: - Add four-digit year compatibility
SEL-DTA-R212	Two stop bits: Base Product
	This firmware differs from the previous version as follows: - Setting error message correction
SEL-DTA-R211	Two stop bits: Base Product
SEL-DTA-R605	One stop bit: Base Product
	This firmware differs from the previous version as follows: - 2 1/2 element power calculation for delta fast meter - SEL-251 demand and reset demand/peak - Fast meter single-phase power for analog output - One minute timeout for freeze meter function
SEL-DTA-R210	Two stop bits: Base Product
SEL-DTA-R604	One stop bit: Base Product
	This firmware differs from the previous version as follows: - FL analog output reset correction
SEL-DTA-R209	Two stop bits: Base Product
SEL-DTA-R603	One stop bit: Base Product
	This firmware differs from the previous version as follows: - Added SEL-267/167 Demand Meter Support - Added SEL-251 Delta Version Meter Support - Added SEL-251-1 Versions Meter Support - Added SEL-221F/121F Fault Type 6 Support
SEL-DTA-R208	Two stop bits: Base Product
SEL-DTA-R602	One stop bit: Base Product
SEL-DTA-R207	Two stop bits: Base Product
SEL-DTA-R601	One stop bit: Base Product

To find the firmware revision number in your DTA2, type the **VERSION** command from Access Level 1 or 2. The following is an FID number with the Part/Revision number in bold:

FID=**SEL-DTA-R212**-V22-D070123

Relay Compatibility

The following list summarizes the SEL relays that are compatible with SEL-DTA2 firmware listed above. If a relay is not listed, it is not compatible with the SEL-DTA2 firmware.

Table A.2 SEL Relay Models Compatible With the SEL-DTA2

Relay Model Numbers
SEL-49
SEL-121, -1, -2, -2A, -3, -4, -5, -6, -8
SEL-121/221-10, -16, -17
SEL-121B/221B, -1
SEL-121C/221C, -1
SEL-121D/221D
SEL-121F/221F, -1, -2, -3, -8
SEL-121G/221G, -3, -4, -5, -6, -7, -8, -9, -11
SEL-121H/221H
SEL-121S/221S
SEL-151/251, -1, -2, -3
SEL-151C/251C, -1, -2, -3
SEL-151CD/251CD, -1, -3
SEL-151D/251D, -1, -3
SEL-167/267, -2, -5
SEL-167D/267D
SEL-311A, B, C, L
SEL-321, -1, -5
SEL-351 series relays and recloser controls
SEL-PG10/2PG10, -7, -8