

TRAKIT-25P

Printings

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Version 2.10: 01/19/04

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SPECIFICATIONS

Input voltage	11VDC - 18VDC
Standby current @ 13.8VDC with GPS receiver and antenna	125mA 310mA
Temperature range	0 to +70 deg C
Relative humidity	90% at 50 deg C
Weight	1.1 lb.
Dimensions	5.5" x 5.5" x 1.5"

1.0 GENERAL DESCRIPTION

1.1 Description

The TrakIt-25P provides a full-featured Automatic Vehicle Location (AVL) system for fleet management using the Global Positioning System (GPS). The TrakIt-25P contains a GPS receiver and a data buffer. Numerous events can be programmed to generate position records and a built in data port provides additional features such as messaging.

An APCO Project 25 compliant radio system is used to provide an RF data link between the TrakIt-25P and the AVL base computer. Position data accumulated in the data buffer as well as real-time position data is sent to the AVL base computer through the APCO Project 25 radio system using an APCO Project 25 compliant radio. Interface cables are available for quick and easy installation.

1.2 Capabilities and Features

- ◆ Incorporates protocols necessary for operation on APCO Project 25 radio systems.
- ◆ Interface cables are available for easy installation.
- ◆ Operating and timing parameters are stored in non-volatile EEPROM and can be programmed to meet system requirements.
- ◆ Data port has numerous programmable operating modes.
- ◆ Three event input signals allow position records to be generated on external events.
- ◆ Multi-input expander option provides 8 additional inputs that allow position records to be generated on external events.
- ◆ Three external outputs allow control of external devices by the AVL base software.
- ◆ On board battery backed position buffer holds 1000+ records.
- ◆ Internally located GPS receiver board.

2.0 INSTALLATION AND SETUP

2.1 Inspection

Please refer to the checklist packed with the TrakIt-25P in order to become familiar with the unit and to insure that everything ordered has been received. In the event a part is missing from the checklist, please call the Customer Services Department at 1-701-280-1122.

This unit was thoroughly inspected before leaving the factory. If the outer package appears damaged, please inspect the unit for possible damage immediately. Any dents, scratches, or marks suggest rough handling in shipping. Please notify the shipper if you find any indications of mishandling. If there are any concerns about the condition of the TrakIt-25P when it is received, please don't hesitate to call the Customer Services Department.

2.2 Disassembly and Reassembly

To remove the TrakIt-25P printed circuit board from its case, remove the two black screws from the front of the TrakIt-25P and then remove the front panel. Remove the top cover by sliding it off the TrakIt-25P. Since the printed circuit board contains sensitive circuitry, be sure to take the necessary precautions against static discharge.

To reassemble the TrakIt-25P, replace the top cover and the front panel making sure the front and back panels are seated properly with the case. Replace the two black screws but do not over-tighten them.

2.3 Installation Procedure

This section describes the general procedure for installing the TrakIt-25P in a vehicle. For additional and more detailed information, refer to sections 2.4 – 2.10.

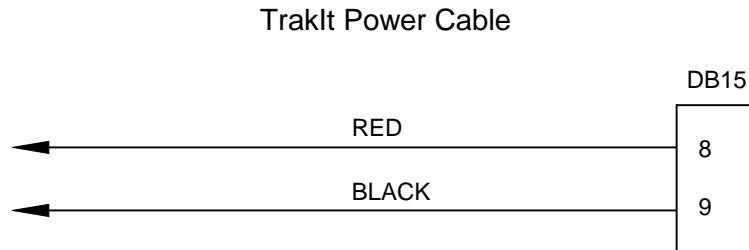
1. Set the TrakIt-25P up for a bench test by applying power to the TrakIt-25P and connecting Data Port 1 of the TrakIt-25P to the serial port of the computer that the AVL Installer program is on. Use the AVL Installer program to do the following:
 - Program the installer table as required to give the TrakIt-25P a vehicle name and to allow the TrakIt-25P to operate with any external devices which will be used.
 - Initialize the unit ID unless the automated initialization feature will be used.
 - Set the operating mode of Data Port 1 as required.
 - Program the APCO-25 setup as required.
 - The position send timeout in the operator table should be set to at least 30 seconds in most cases for proper operation.

2.3 Installation Procedure (cont.)

2. Program the frequencies and features as required in the APCO Project 25 radio that the TrakIt-25P will be connected to.
3. Connect Data Port 2 of the TrakIt-25P to the radio's data port. The TrakIt-25 DTE/DCE Data Port Cable can be used to make this connection.
4. Obtain power for the TrakIt-25P from either the radio or the vehicle's battery. The TrakIt Power Cable can be used for this.
5. Install the TrakIt-25P along with the radio into the vehicle. Refer to the radio's manual for instructions on installing the radio into a vehicle. The TrakIt-25P should be installed in close proximity to the radio. An optional mounting bracket kit is available to assist in mounting the TrakIt-25P in the vehicle. Be sure to allow sufficient space around the radio and TrakIt-25P for air-cooling.
6. Install the GPS antenna and connect it to the TrakIt-25P.
7. The IP address assigned to the TrakIt-25P must also be assigned to the unit ID of the TrakIt-25P in the AVL base software. If the automated initialization feature is used, this will be done automatically.
8. Ensure that position buffer downloads, if done through the APCO Project 25 radio system, occur during off-peak hours.

2.4 Radio Connection

Connector J1 (labeled "RADIO") is used to interface the TrakIt-25P to the radio to obtain power (power can also be obtained from the vehicle's battery). Connector J1 is also used to interface the event input signals and the external outputs of the TrakIt-25P to external devices when required. The TrakIt Power Cable can be used for connecting power to the TrakIt-25P. Following is the wiring diagram of the TrakIt Power Cable.



By adding wires to this cable, the event input signals and the external outputs can be connected. Following is a description of the function of each pin of connector J1.

- 1,2. These pins are not used.
3. This is the event input 2 signal pin. The TrakIt-25P uses this pin to determine the state of an external device. Position records can be generated by the TrakIt-25P when the state of the external device changes. The event input 2 signal pin is de-bounced and any new input level on this pin should be held for at least 1 second. The event input 2 signal pin can be programmed as either an active high or active low input.
4. This is the event input 3 signal pin. The TrakIt-25P uses this pin to determine the state of an external device. Position records can be generated by the TrakIt-25P when the state of the external device changes. The event input 3 signal pin is de-bounced and any new input level on this pin should be held for at least 1 second. The event input 3 signal pin can be programmed as either an active high or active low input.
5. This is the event input 1 signal pin. The TrakIt-25P uses this pin to determine the state of an external device. Position records can be generated by the TrakIt-25P when the state of the external device changes. The event input 1 signal pin is de-bounced and any new input level on this pin should be held for at least 1 second. The event input 1 signal pin can be programmed as either an active high or active low input.
- 6,7. These pins are not used.

2.4 Radio Connection (cont.)

8. This pin is used to supply power to the TrakIt-25P. It should be connected to a point in the radio that will provide 13.8 VDC to the TrakIt-25P. It is recommended that the radio's power switch control power to the TrakIt-25P as well. As an alternative, this pin can be connected to the vehicle's battery. If the TrakIt-25P is to be powered on and off with the ignition to prevent battery drain, an ignition relay must be installed or the power connection must be made to a switched accessory connector.
9. This is the ground pin. It should be connected to the radio's ground or to the vehicle's ground.
10. This is the external output 3 pin. The state of this pin is controlled by the AVL base software. This allows a device in the vehicle to be enabled and disabled from the base site. The external output 3 pin can be programmed as either an active high or active low output.
11. This is the TXD pin of Data Port 2 when switch SW4 is set to position A. This pin is not currently used and should be left unconnected.
12. This is the RXD pin of Data Port 2 when switch SW4 is set to position A. This pin is not currently used and should be left unconnected.
13. This is the external output 1 pin. The state of this pin is controlled by the AVL base software. This allows a device in the vehicle to be enabled and disabled from the base site. The external output 1 pin can be programmed as either an active high or active low output.
14. This is the external output 2 pin. The state of this pin is controlled by the AVL base software. This allows a device in the vehicle to be enabled and disabled from the base site. The external output 2 pin can be programmed as either an active high or active low output.
15. This pin is the 5 VDC output from the TrakIt-25P and does not generally need to be connected.

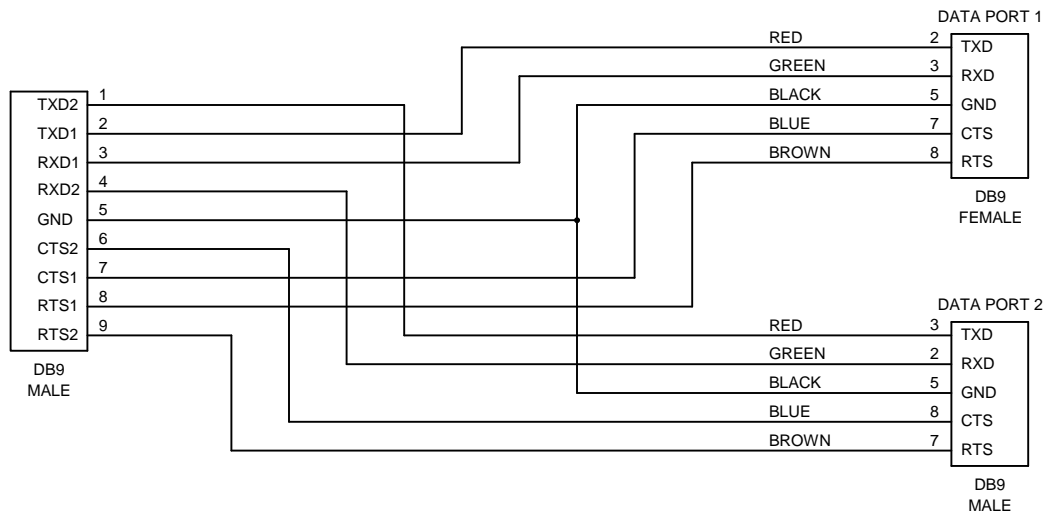
2.5 Data Port Connection

Connector J2 (labeled “DATA PORT”) provides the connections for two serial ports, Data Port 1 and Data Port 2. Data Port 1 is used to make a serial connection from the TrakIt-25P to a computer, a TrakIt Vehicle Terminal, or some other device depending upon its operating mode. Data Port 2 is used to make a serial connection from the TrakIt-25P to the data port of an APCO Project 25 radio. The pin-out for connector J2 is as follows:

Pin #	Function
1	TXD2
2	TXD1
3	RXD1
4	RXD2
5	GND
6	CTS2, or 5VDC, or 10VDC
7	CTS1
8	RTS1
9	RTS2

The TrakIt DTE/DCE Data Port Cable provides separate connectors for Data Port 1 and Data Port 2. The Data Port 1 connector is a DCE DB-9 and the Data Port 2 connector is a DTE DB-9. Following is the wiring diagram of the TrakIt DTE/DCE Data Port Cable.

TRAKIT DTE/DCE Data Port Cable



2.5 Data Port Connection (cont.)

The Data Port 2 connector should be connected directly to the data port of an APCO Project 25 radio. Since Data Port 1 has many different programmable modes of operation, what the Data Port 1 connector is connected to is determined by the selected operating mode. The AVL Installer program can be used to change the operating mode of Data Port 1. The operating modes of Data Port 1 are as follows:

NMEA - In this mode, NMEA messages that are received from the GPS receiver are sent to Data Port 1. Data Port 1 should be connected to a computer or some other appropriate device.

Supervisor/Monitor - This mode allows the AVL Supervisor/Monitor software to communicate with the TrakIt-25P. Data Port 1 should be connected to the computer that will be running the AVL Supervisor/Monitor software.

ASCII In/Out - This mode allows ASCII dispatch messages to be sent and received through Data Port 1. Data Port 1 should be connected to a computer or some other appropriate device.

Vehicle Terminal - This mode allows the TrakIt Vehicle Terminal to send and receive dispatch messages through Data Port 1. Data Port 1 should be connected to the TrakIt Vehicle Terminal.

VDO - This mode allows the TrakIt-25P to communicate with a VDO on-board computer. Data Port 1 should be connected to the VDO on-board computer.

Raven - This mode allows the TrakIt-25P to communicate with a Raven AMS console. Data Port 1 should be connected to the AMS console.

To connect Data Port 1 to the serial port of a computer, connect the Data Port 1 connector directly to the computer or use a male DB-9 to female DB-9 serial cable with straight through connections. If the computer's serial port is a DB-25, a DB-9 to DB-25 adapter will need to be used. The following table details the connections that are made between Data Port 1 and the computer.

Data Port 1 DB-9	Computer DB-9	Computer DB-25
2 - TXD	2 - RXD	3 - RXD
3 - RXD	3 - TXD	2 - TXD
5 - GND	5 - GND	7 - GND
7 - CTS	7 - RTS	4 - RTS
8 - RTS	8 - CTS	5 - CTS

2.6 GPS Antenna Connection

The TrakIt-25P comes with a GPS receiver and a GPS antenna. The GPS antenna should be connected to the connector on the back of the TrakIt-25P that is labeled "GPS ANT". The GPS antenna is either magnetic mount or permanent mount and should be mounted to a flat horizontal surface that will have an unobstructed view of the sky. When installing the GPS antenna, be sure that the antenna cable is not pinched or run past sharp edges.

2.7 Multi-Input Expander Cable Connection

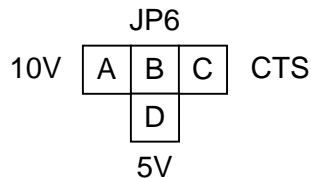
The Multi-Input Expander Cable option provides 8 inputs to the TrakIt-25P. The TrakIt-25P uses these inputs to determine the state of external devices. Position records can be generated by the TrakIt-25P when the states of the external devices change. The inputs are de-bounced and any new input level must be held for at least 1 second to be recognized. The inputs can be programmed as either active high or active low.

The Multi-Input Expander Cable provides the connection to the external devices through a standard 15 pin Molex connector. Eight pins are used for the input signal connections and the other seven pins provide ground connections. Refer to the Multi-Input Expander Cable schematic at the end of the manual for further information on connecting the cable to external devices.

2.8 Jumper and Potentiometer Settings

Any jumpers or potentiometers on the TrakIt-25P printed circuit board are either not installed or have been factory set as required and should not be changed. The only exception is JP6 which is described below.

JP6 - This jumper determines if the Data Port 2 CTS pin is used for CTS signal input or if it will provide power to the device connected to Data Port 2. CTS signal input is selected if JP6 is jumpered to B-C. Otherwise, power output is selected if JP6 is jumpered to A-B (10V) or B-D (5V) as shown in the following diagram. For proper operation, JP6 must be set to B-C (CTS signal input).



A shorting block may be installed on JP6 at the factory but since shorting blocks can vibrate off when the TrakIt-25P is installed in a vehicle, it should be removed and the necessary connections should be made with wire wrap wire or by bending the posts together and soldering them.

2.9 Dip Switch Settings

The following describes the function of each of the dip switches on the TrakIt-25P.

SW1-1,2: These switches are not used and should be left unchanged.

SW1-3: This switch routes the received data from Data Port 1 to the GPS receiver board. This switch should normally be in the OFF position.

SW1-4: This switch routes the received data from Data Port 1 to the TrakIt-25P's micro-processor. This switch should normally be in the ON position.

SW2: This switch determines if Data Port 1 is at TTL levels or at RS232 levels. Position A selects TTL levels and position B selects RS232 levels. This switch should normally be set to position B.

SW3: This switch determines if Data Port 2 is at TTL levels or at RS232 levels. Position A selects TTL levels and position B selects RS232 levels. This switch should be set to position B.

SW4: This switch determines if Data Port 2 is routed to the radio port or to the data port. Position A selects the radio port and position B selects the data port. This switch should be set to position B.

2.10 AVL Installer Program

The AVL Installer program is used only by the installer and allows the many different programmable parameters of the TrakIt-25P to be tailored to the APCO Project 25 system on which it will operate. To change the programmable parameters of the TrakIt-25P, the serial port of the computer that the AVL Installer program is on should be connected to Data Port 1 of the TrakIt-25P. The AVL Installer program can then be used to change the programmable parameters of the TrakIt-25P no matter what operating mode Data Port 1 is in.

The AVL Installer program contains an installer table and an operator table plus additional parameters that are accessible through the menus. The parameters contained in the installer table and accessible through the menus configure the TrakIt-25P for operation with the APCO Project 25 radio and any external devices which will be used and can be changed only by the installer using the AVL Installer program. The parameters contained in the operator table determine how the TrakIt-25P handles position records and can be changed by the installer using the AVL Installer program or by the operator using over the air programming.

2.10 AVL Installer Program (cont.)

To change the installer table settings, the installer should use the AVL Installer program to edit the installer table and then upload the installer table to the TrakIt-25P. To change parameters that are accessible through the menus, the installer should select the appropriate menu and make the necessary changes. The installer does not normally need to edit and upload the operator table since the operator can change the operator table settings using over the air programming. In addition, the installer does not need to initialize the unit ID since the automated initialization feature will allow the operator to initialize the unit ID after the TrakIt-25P has been installed in a vehicle.

The different parameters that are available in the installer table are described below.

Vehicle Name - Vehicle name helps the system operator identify which vehicle is connected when the automated initialization feature is being utilized. Use an identifier here that the operator will equate to the vehicle (for example, "Red truck" or "Truck 112").

Event input (1, 2, or 3) signal active - If the event input signal is active high, this should be set to high. If the event input signal is active low, this should be set to low. The TrakIt-25P can use the three event input signals to generate position records based upon external events.

External output (1, 2, or 3) active - If the external output needs to be active high, set this to high. If the external output needs to be active low, set this to low. The TrakIt-25P can use the three external outputs to enable and disable other devices in the vehicle.

Line (1 - 8) signal active - If the input signal provided through the Multi-Input Expander Cable is active high, this should be set to high. If the input signal is active low, this should be set to low. The TrakIt-25P can use the input signals to generate position records.

Using the AVL Installer program menus, the operating mode of Data Port 1 can be set. The APCO-25 setup parameters can also be set using the menus. The APCO-25 setup parameters are described below.

Unit IP - This is the IP address of the TrakIt-25P. The *Unit IP* address should be allocated from the block of IP addresses assigned to the APCO Project 25 radio system that the TrakIt-25P will communicate across.

System IP - This is the IP address that messages originated by the TrakIt-25P will be sent to. The TrakIt-25P can respond to messages from multiple hosts, but messages originated by the TrakIt-25P can only be sent to the *System IP* address.

PARTS LIST

TRAKIT-25P PCB BOARD 101-0277

Item	Reference	Description	Part No.	Qty.
1	B1	3V BATTERY	399-0008	1
2	B1	3V BATTERY HOLDER	399-0009	1
3	C4,6	10uF ELEC. CAP	360-0004	2
4	C7,8,9,10,12,13,14,15, 16,19,20,21,22,23,29, 41,63	.1uF 10% X7R CAP	372-5104	17
5	C11	220uF ELEC. CAP	360-0007	1
6	C17,18,27,28	18pF 5% NPO CAP	372-5180	4
7	C49,50,51,52,53,54, 55,56,57,58,59,60,61, 62	.01uF 10% X7R CAP	372-5103	14
8	D1,2,4	1N4148 DIODE	110-0018	3
9	D3	1N4003 DIODE	110-0002	1
10	D5,6,7,8	1N5232 5.6V ZENER DIODE	111-0018	4
11	F1	1 AMP PC MOUNT FUSE	290-0008	1
12	J1	DB15 FEMALE CONN R/A	231-0031	1
13	J2	DB9 FEMALE CONN R/A	231-0026	1
14	J1,2	HEX NUT 4-40	199-0010	4
15	J1,2	WASHER, STAR #4	199-2001	4
16	J1,2	SCREW, 4-40 x 3/8 PHLP	199-3056	4
17	J3	8 POS HEADER	231-1518	1
18	J4	7 POS HEADER	231-1517	1
19	JP5	STAPLE JUMPER	265-0016	1
20	JP6	1 POS JUMPER POST	231-1001	1
21	JP6	3 POS JUMPER POST	231-1003	1
22	JP6	SHORTING JUMPER	234-0046	1
23	P1	8 POS DIP CONN	234-0022	1
24	Q1,2,3,4,5,6,8,9,10,11, 12,13,14,15	MMUN2211 TRANSISTOR	180-0040	14
25	R4	1M 5% 1/8 W RES	321-1105	1
26	R5,8,9,11,12,13,14,16, 18,34,35,38,39,52,53, 54,55,56,57,58,59,60, 61,62,63,64,65	10K 5% 1/8 W RES	321-1103	27
27	R6,19	100K 5% 1/8 W RES	321-1104	2
28	R7,10,15,17	100ohm 5% 1/8 W RES	321-1101	4
29	R66	4.7K 5% 1/8 W RES	321-1472	1
30	SW1	4 POS DIP SWITCH	613-0002	1
31	SW2,3,4	DPDT SWITCH	611-0048	3
32	U2	80C32 IC	131-3005	1
33	U3	UA7805 TO-220 IC	130-0022	1
34	U4	27C512 IC	130-0319	1

35	U5	74HCT00 IC	131-1026	1
36	U6	74HCT245 IC	131-1023	1
37	U7	74HC373 IC	131-1022	1
38	U8	208 IC	131-1032	1
39	U9	24LC04 IC	131-1029	1
40	U10	60L256 IC	131-1024	1
41	U11	74HC244 IC	131-1021	1
42	U12	74HC138 IC	131-1020	1
43	U14	88C681 IC	131-3004	1
44	U21	695 IC	131-1018	1
45	U22	MM74HC573WM IC	131-1055	1
46	U23	74HC08M IC	131-1034	1
47	U24	74HC32 IC	131-1031	1
48	U2	44 PIN PLCC SOCKET	220-0011	1
49	U3	T0220 INSULATOR	210-0103	1
50	U4	28 PIN DIP SOCKET	220-0008	1
51	X2	3.579545MHZ CRYSTAL	305-0001	1
52	X3	11.0592MHZ CRYSTAL	305-0012	1
53	X2,3	CRYSTAL INSULATOR	210-0106	2
54		SPACER, 4-40 x 3/8	200-0305	4
55		PC BOARD TRAKIT-25	900-0277	1

**TRAKIT-25P CABINET
103-0277**

Item	Description	Part No.	Qty.
1	NUT, HEX, 4-40	199-0010	1
2	WASHER, STAR #4	199-2001	1
3	SCW, 4-40 X 1/4 SLOT	199-3055	1
4	S/N LBL IDA PRODUCT	199-6009	1
5	NUT, PEM 6-32 FLUSH	200-0056	4
6	BACKPLATE, TRAKIT	900-6062A	1
7	CABINET, TRAKIT	900-6071	1
8	FACEPLATE (w/o Multi-Input)	900-6072S	1
9	FACEPLATE (w/ Multi-Input)	900-6077S	1

TRAKIT-25P MULTI-INPUT EXPANDER CABLE

Item	Description	Part No.	Qty.
1	MULTI-INPUT CABLE ASSY	800-2092	1

**TRAKIT-25P GPS RECEIVER KIT
105-0277**

Item	Description	Part No.	Qty.
1	NUT, HEX 10 X 32	199-0046	1
2	SCW, #4-40 X 1/4 SLOT	199-3055	4
3	GPS RECEIVER BD.	902-0006	1

GPS MAGNETIC ANTENNA

Item	Description	Part No.	Qty.
1	GPS MAGNETIC ANTENNA	902-0007	1

GPS PERMANENT ANTENNA

Item	Description	Part No.	Qty.
1	GPS PERMANENT ANT.	902-0011	1

**TRAKIT CABINET BRACKET KIT
103-5025**

Item	Description	Part No.	Qty.
1	SCW, #10 X 3/4 SHEET MET.	199-1009	4
2	SCW, #6-32 X 3/16 PHILLIPS	199-3068	4
3	WASHER, STAR #6	199-2002	4
4	BRACKET, TRAKIT ANOD.	900-5025A	1

**TRAKIT DTE/DCE DATA PORT CABLE
106-TRDTE DCE**

Item	Description	Part No.	Qty.
1	SCREW CLIP KIT	231-0014	2
2	MALE DB9 CONNECTOR	231-0071	2
3	FEMALE DB9 CONNECTOR	231-0072	1
4	DB9 SELF LOCK HOUSING	231-0073	3
5	SCREW LOCK KIT	231-0074	2
6	6 COND CABLE	800-1112	2'

TRAKIT POWER CABLE

106-TRPWRCBL

Item	Description	Part No.	Qty.
1	SCREW CLIP KIT	231-0014	1
2	MALE DB15 CONNECTOR	231-0035	1
3	DB15 CONN HOUSING	231-0036	1
4	2 COND CABLE	800-1106	10'

SCHEMATICS