FAIRCHILD MODEL T1750 SERIES ELECTRO-PNEUMATIC TRANSDUCERS (Analog Output) Operation and Maintenance Instructions Software Version 3.45 and 3.46

Figure 1. Model T1750 Keypad

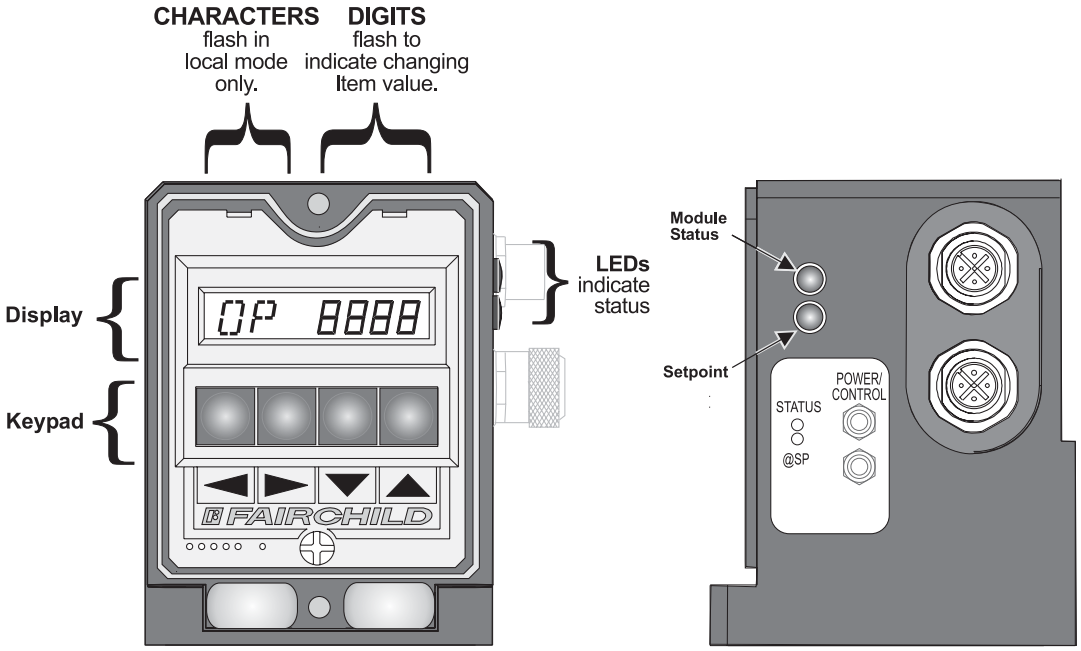

Figure 2. Model T1750 Series Transducer Keypad Functions

	Main menu/Sub-menu items (digits not blinking)	Item value - (digits blinking)
▲	Go to previous menu item.	Go to previous item value.
▼	Go to next menu item.	Go to next item value.
►	Go to Sub-menu. Select item value to change, starts blinking.	Accepts new value. (ENTER) Stops blinking.
◄	Go to OP.	Does not accept new value.(ESC) Stops blinking.

GENERAL INFORMATION

The Model T1750 Series Electro-Pneumatic I/P, E/P transducers Control Output Pressure in proportion to an analog input signal.

When you apply initial power to the units, 0P displays on the Main Menu. If the keypad is inactive for three minutes, the unit returns to 0P. If power is disrupted, the unit returns to its last setting when power is restored.

These devices use feed and bleed solenoid valve control technology, digital feedback electronic control, and an internal electronic pressure sensor to achieve high accuracy pressure control. Flexible configuration and PID tuning capability ensure that these pressure controllers can meet the most demanding air pressure control applications.

SPECIFICATIONS

Model T1750

Electrical

Supply voltage ..... 24 VDC
Power consumption ..... Less than 4 watts
Control Input .....
Current Mode
Normal ..... 4-20 mA
Maximum ..... 0-24 mA
Without Damage ..... 35 mA

Voltage Mode
Normal ..... 0-10 VDC
Maximum ..... 0-12 VDC
Voltage Input Mode clamped @ 13 VDC

Pneumatic

Maximum Supply pressure: ..... 1000 psig
Minimum Supply Pressure ..... .No less than 50 psig above maximum output

Forward Flow Capacity ..... Up to 120 ..... SCFM @ 600 psig

Exhaust Flow Capacity ..... Up to 20 SCFM

Air Quality ..... Instrument Air ..... per ISA S7.0.01 Recommended

Input signal / Impedance: .... 4-20 mA / 246 ohms, 0-10 VDC / 500k ohms

Caution:

Pressures up to 1000 psig are used to operate this unit. Proper connections and procedures must be followed to maintain safety for personal and equipment. Remove pressure supply and bleed lines as residual pressures may be present when disconnecting units from system.

Table 1. Main Menu *(shown in red)*

Item	Description	Range
OP	**Output Pressure -** Displays the actual output pressure.	0-750 psig, [0-50 BAR], (0-5 MPa)
SP	**Setpoint -** Sets/displays the required process variable.	0-750 psig, [0-50 BAR], (0-5 MPa)
CV	**Control Value -** Displays control input value.	0-24 mA or 0-12 VDC
OV	**Option Value** - Displays the feedback option output value.	0-24 mA or 0-12 VDC
S	**Setup Menu -** Accesses the Setup Menu.	See Table 2.
C	**Calibration Menu -** Accesses the Calibration Menu.	See Table 3.
T	**Tuning Menu -** Accesses the Tuning Menu.	See Table 4.
OC	**Output Control** - Sets the mode of operation for the analog output.	OP or USEr
LR	**Control Input -** Sets the mode of operation for the control input.	Remote or Local

Table 2. *Setup Menu (Option S on the Main Menu - shown in blue)*

Item	Description	Range
CU	**Control Units -** Sets the operating units for control input.	mA or VDC
OU	**Option Units -** Sets the operating units for the analog output option	mA or VDC
EQ	**Look Ahead Function -** [1] Improves setpoint accuracy and response time.	Enable or Disable
N/	**Numerator -** Sets/displays pressure unit conversion factor.	0-9999
/D	**Denominator -** Sets/displays pressure unit conversion factor.	0-9999

Table 3. Configuration Menu *(Option C on the Main Menu)*

Item	Description	Range
P1	**Output pressure 1 -** Sets the output pressure required at the existing setpoint. Typically 0%.	0-750 psig, [0-50 BAR], (0-5 MPa)
P2	**Output pressure 2 -** Sets the output pressure required at the existing setpoint. Typically 100 %.	0-750 psig, [0-50 BAR], (0-5 MPa)
C1	**Control Value 1 -** Sets the 0 % Control Input value.	0-24 mA or 0-12 VDC
C2	**Control Value 2 -** Sets the 100% Control Input value.	0-24 mA or 0-12 VDC
O1	**Option 1 -** Sets the value of the current or voltage proportional to P1.	0-24 mA or 0-12 VDC
O2	**Option 2 -** Sets the value of the current or voltage proportional to P2.	0-24 mA or 0-12 VDC
L1	[2] Records the low pressure look ahead coefficient.	10% of full scale
L2	[2] Records the high pressure look ahead coefficient.	90% of full scale

Table 4. Tuning Menu *(Option T on the Main Menu)*

Item	Description	Range
KP	**Proportional -** Sets the proportional gain.	0 - 63.99
KI	**Integral -** Sets the reset time.	0 - 9.99 repeats per second
KD	**Derivative** - Sets the rate of change.	0 - 6.399 seconds
DB	**Dead Band** - Sets the amount of pressure centered on the setpoint which the unit does not respond.	0 - 10% maximum pressure (Value displayed in pressure units)

[1] **L1 and L2 must** be set for **EQ** to work correctly.
[2] Recommend 60% difference in the range (value) between **L1** and **L2** . A **zero** value is **not** recommended.

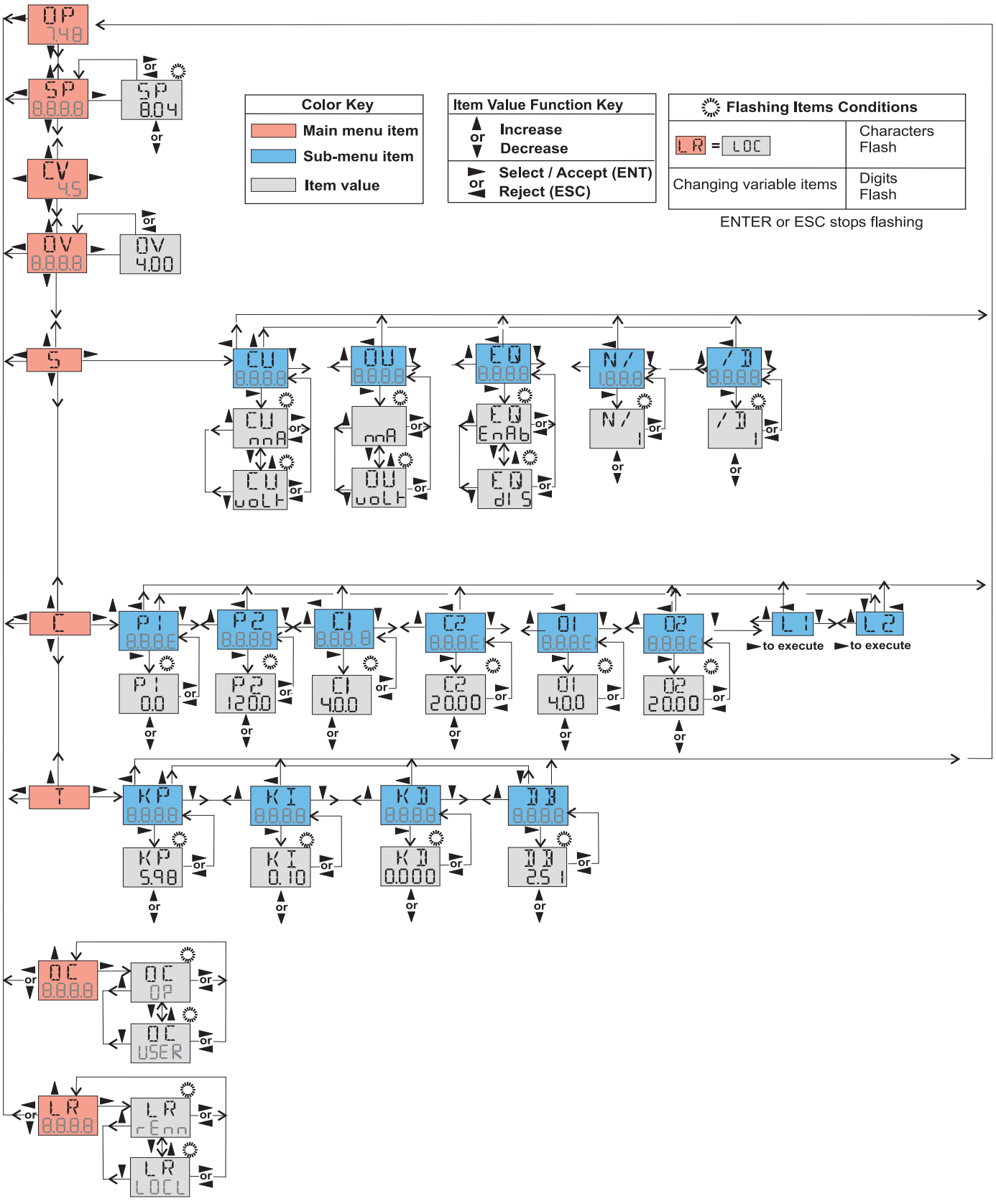

Figure 2. Model T1750 Menu System

OPERATING MODES

The Model T1750 is configurable for controlling output pressure or a process variable. Use the Control Input LR and Analog Output connection OC menu items to set these operating modes. See Table 5, Quick Setup, for the 4 basic operating modes. Main menu items are shown in red and submenus in blue. Use Tables 1 through 4 and Figure 2 as guides for operating and navigating through the various menus.

Controlling Output Pressure

Setting the Control Input LR to Local LOCL allows the Setpoint SP on the Model T1750 to control the output via the keypad. Note that the 2 character alpha display blinks in this setting. Setting the Control Input LR to Remote rEmn configures the Control Input channel as an analog setpoint control.

Controlling output pressure: The Model T1750 uses an internal pressure sensor for closed loop control of output pressure. The Setpoint SP and Deadband DB display in terms of output pressure units. A "P" fitting adapter is provided to remotely sense output pressure. The adapter pipes the feedback pressure to the internal pressure sensor from a remote location. The display returns to OP if the keypad is inactive for three minutes.

Controlling Output Pressure with Analog Setpoint Control

Control Input LR set to Remote rEmn: The Model T1750 control input channel is configured to accept an analog control signal to control the setpoint. The Control Value CV displays the current or voltage signal value at the control input terminals under all configurations. The relationship between the control input signal and the output pressure is determined by P1, P2, C1 and C2 settings in the Configuration C menu.

Output Control - Analog Output Option

The Analog Output Option OC may be set to output a current or voltage signal that is proportional to the pneumatic output pressure or an independant analog output channel controlled via the keypad while in the OV menu.

Set the value of OC to OP for analog output that is proportional to the Output Pressure. The relationship between the analog output signal and the output pressure set in the C configuration menu by entering the appropriate values for P1, P2, O1, and O2. See Tables 1 & 3 and Figure 2 for more information. Set the value of OC to USEr to control the analog output from the keypad using the OV menu item.

Table 5: Quick Setup

T1750 Configuration Settings for Operating Modes for Software Versions starting at V3.45

T1750 Configuration	LR= LOCL OC=USER	LR= REM OC= USER	LR= REM OC=OP	LR= LOCL OC=OP
Operating Mode	SP (Keypad) Controls Output OP Keypad Controls OV	CV Controls Output OP Keypad Controls OV	CV Controls Output OP OV Follows OP	SP (Keypad) Controls Output OP OV Follows OP

LR Control Input Mode Switch Alpha characters blink in LOCL mode

MENU ITEM FUNCTIONS

Output Pressure (OP)
Displays the actual output pressure in the default PSIG units. BAR and kPa units can be displayed based on configuring (N/) and (/D) as discussed in the Pressure Conversion section. See Table 6.

Setpoint (SP)
Configuring the Model T1750 to control output pressure OP, the Setpoint SP menu item on the Main menu displays the setpoint in terms of output pressure. Selecting Setpoint SP with the control input channel LR in Local LOCL mode causes the numberic characters to blink unitl the value required is reached via the up/down buttons and entered. Use Control Input LR configured in Remote rEnn for controlling the output pressure proportional to the signal value at the control input channel terminals. This is defined by the calibration relationship of P1, P2, C1, and C2 in the Configuration Menu C. Setpoint SP displays the current pressure setpoint value.

Control Value (CV)
Displays the control input value in mA or Volts.

Option Value (OV)
The Option Value OV displays the current or voltage value at the analog output option terminals.

Setup Menu (S)
See Table 2 and Figure 2 for setup options.

Calibration Menu (C)
See section 'Control Input Used as Setpoint Control' , Table 3 & Figure 2 for setup options.

Tuning Menu (T)
See Configuring Menu T Tuning Coefficients, Table 4 & Figure 2 for setup and PID Tuning Information.

Analog Output Connection (OC)
Sets the mode of operation for the Analog output option to OP or USEr. Setting option to OP configures the Output Option to proportinally follow the output pressure in mA or volts. The value is displayed in Option Value OV. Setting option to USEr configures the Output Option to be used as an independent keypad settable output signal in mA or Volts and is displayed in the Option Value OV. See Table 5, Quick Setup Guide.

Control Input (LR)
Control Input LR configures the control input channel function. Setting LR in Remote USEr mode, the control input channel functions as setpoint control to the Model T1750. Control Input LR set to LOCAL LOCL chooses the Setpoint SP using the keypad to control the output pressure. In this mode, the Model T1750 control functions disregard the analog input channel.

NOTE: The Control Input LR and the Analog Output Connection OC have four setting combinations that configure the Model T1750 operation. See Table 5, Quick Setup.

Setup Menu (S) Operation Control Units CU
Sets control input units in mA nnA or volts volt . Values are input in the Configuration Menu C as C1 and C2.

Analog Output Option Units (OU)
To change the Analog Output Option Units OU between voltage volt and current nnA enter the appropriate unit on the OU menu.

Look Ahead Function (LO)
Using the Look Ahead LO function can reduce the gain error and enhance the Model T1750 response characteristics in most linear control applications. To improve response characteristics, the Look-Ahead LO function predicts the required internal control correction for a specific setpoint based on the characterizing values L1 and L2. To achieve optimum look-ahead characteristics, the Configuration C menu items L1 and L2 must be set with the Model T1750 operating with the supply pressures they will use in their applications.

Pressure Unit Conversion (N/) and (/D)
The Model T1750 Output Pressure OP can display in any required pressure unit. To convert to other pressure units, set the values of menu items Numerator N/ and Denominator /D. Values entered in N/ and /D form a fractional conversion factor that converts the base units of pressure (psig) in the Model T1750 into the required units. The converted (new pressure) unit is determined by the expression *Converted Pressure Unit* = (pressure in psig) x (N/D). Consult a conversion table to obtain a conversion factor for the required units, convert into a fractional form, and enter it into the Model T1750 using N/ and /D.

Pressure Unit Conversion (N/) and (/D) cont.

The values of N/ and /D are integers only and are limited to the range of 1 to 9999. The Model T1750 ship from the factory with units of psig, BAR, or kPa determined by the part number. The Model T1750 automatically determines the Output Pressure OP Decimal Point location DB based on the maximum Output Pressure OP after the N/D conversion.

NOTE: **The Setpoint SP and Deadband DB item values display in terms of the converted pressure units defined by the N/ and /D conversion factor.**

For more information about N/ and /D values for common pressure units, see Table 6.

Table 6. Pressure Unit Values

Unit	N/	/D	Comments
psig	1	1	psig = psig x 1
BAR	100	1451	bar = psig x 0.0689
kPa	6895	1000	kPa = psig x 6.895
InHg	5000	2456	InHg = psig x 2.036

Configuration Menu C Operation

Control Value used as Setpoint Control (P1), (P2), (C1) and (C2)

The values in P1, P2, C1 and C2 set the relationship between the control input signal and the output pressure. Setpoint is displayed in terms of the output units. Configuring the control input for setpoint control, (LR = rEmn), allows for the adjustment of the relationship between control input signal and the output. To make the adjustment, set the appropriate values in P1, P2, C1 and C2 on the Configuration C menu. When the control input signal varies between the values in C1 and C2, the pressure output varies proportionally between the values in P1 and P2. For example:

> OU = mA, P1 = 0.00, P2 = 300, C1 = 4.00, and C2 = 20.00; Varying the control input current between 4 mA and 2- mA varies the pressure setpoint proportionally between 0 and 300 psig.
>
> To achieve a reverse acting relationship, set C1 = 20.00 and C2 = 4.00 or set P1 = 300 and P2 = 0.

Option Value (O1), (O2)

Sets the analog value of O1 and O2 proportional to P1 and P2, respectively.

Option Value (O1), (O2) (cont)

> CU = mA, P1 = 0.00, P2 = 300, C1 = 4.00, and O2 = 20.00; The Option Value will vary between 4 mA and 20 mA proportinally following the pressure output between 0 and 300 psig.
>
> To achieve a reverse acting relationship, set O1= 20.00 and O2 = 4.00 or set P1 = 300 and P2 = 0.

Look Ahead Items L1 and L2

To improve response characteristics , the Look Ahead LO function predicts the required internal control correction for a specific setpoint based on the characterizing values L1 and L2. LO must be enabled in the Setup S Menu. The Look ahead LO function is pressure supply sensitive requiring the pressure supply be set at the expected operating value. To set L1 and L2, use the following steps:

1. Set the Deadband DB on the Tuning T menu to zero.
2. Set the Setpoint SP to a value between 10 and 20 % of the maximum operating range.
3. Access the Configuration C menu. Scroll through the menu until L1 displays. Press the enter key, select L1. When L1 flashes on the display, the new value is set.
4. Repeat the procedure for L2 with the setpoint between 70 and 100 % of the operating range.

Configuring Menu T - Tuning Coefficients

The Model T1750 ships from the factory with nominal PID values. Tune the PID coeffecients KP, KI and KD for optimum performance in the Tuning menu T. There are several PID optimization routines used to adjust the PID coefficients. The following is a basic procedure that works in most applications:

1. Start with KP = 1.00, KI = 0, and KD = 0. DB should be set to zero when optimizing PID. Return DB to the required value after optimizing PID.
2. Increment KP by 0.01 or other minimal value.
3. Change the Setpoint SP from 50% full-scale to 70% full-scale. Change the setpoint back to 50%
4. If the output stabilizes, go back to 1.
5. If the output does not stabilize, measure the period (in seconds) of the oscillations and go to step 6.
6. Set KP to 50% of the final unstable value previously identified. Set KI to the period of the oscillations. Set KD = KI x 1/8.

Deadband (db)

Deadband db is the set amount of error, centered about the setpoint where the unit will not take action to correct. To achieve fine control, you can set the Deadband db to zero, however, this causes the control solenoid valves to operate continuously reducing their life cycle.

When the Model T1750 is configured to control output pressure, the Deadband db in terms of output pressure.

Restoring Original Factory Calibration

To restore the factory item values, use the following steps:

1. GO to t
2. Press and hold ▲ until C appears.
3. While holding ▲ press and hold ◀ until the display flashes.

Messages

At startup, message symbols can briefly appear on the display. For an explanation of these message symbols, see Table 7.

Table 7. Messages

Message	Problem	Solution
14, 15	Memory is corrupted	Return the unit to the factory.

LEGAL NOTICE:

The information set forth in the foregoing Operation and Maintenance Instructions shall not be modified or amended in any respect without prior written consent of Fairchild Industrial Products Company. In addition, the information set forth herein shall be furnished with each product sold incorporating Fairchild's unit as a component thereof.

MAINTENANCE

For additional maintenance and troubleshooting information, see Tables 8 and 9.

Table 8. Troubleshooting

Problem	Solution
No Output	• Check the supply filter. • Check the supply pressure. • Check the inlet screen in the booster. • Check the power supply. • Check for an existing Input Signal.
Leakage	• Check for loose fittings. • Check for loose body screws.
Improper Output	• Check for output pressure leakage. • Check calibration.
Erratic Operation	• Check for liquid in the air supply. • Check for loose wires or connections. • Check for improper tuning. • Check proper settings for L1 and L2.
Constant Maximum Output	• The external pressure is not applied to "P" port. ("P" option only).

Table 9. LED Status

LED Status	Module Status (MS)
Off	No power - The device does not have power.
Green	Device operational - The device is operating in a normal condition.
Red	Unrecoverable fault - A RAM or ROM error occured. Return the unit to the factory.
LED Status	**Near Setpoint (NS)**
Off	The device does not have power or is not on line. Check the Module Status LED.
Green	The unit is near setpoint.
Red	The unit is NOT near setpoint.

1. If troubleshooting does not correct the problem, return the transducer to the factory for repair.

2. To replace solenoid valves in the Model T1750, order quantity (2) of Part Number: 290-IPI-001-2.

ISO 9001:2000 FM NO. 25571

ISO 9001:2000 Certified

FAIRCHILD
precision pneumatic & motion control

Fairchild Industrial Products Company
3920 West Point Blvd . • Winston-Salem, NC 27103
phone: (336) 659-3400 • fax: (336) 659-9323
sales@fairchildproducts.com • www.fairchildproducts.com

OM-5T1750AO
Litho in USA
07/06