



Series 654T
Single/Dual Channel Two-Wire Transmitters
Voltage Input

USER'S MANUAL

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Safety Summary - Symbols on equipment:



Means "Caution, refer to this manual for additional information".

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IMPORTANT SAFETY CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ satisfactory overall system design. It is agreed between the Buyer and Acromag, that this is the Buyer's responsibility.

1.0 INTRODUCTION

These instructions cover the hardware functionality of the transmitter models listed in Table 1. Supplementary sheets are attached for units with special options or features.

Table 1: Models Covered in This Manual

Series/ Input/Type	-Options/Output/ Enclosure/Approvals ¹	-Factory Configuration ²
654T	-0600	-C

Notes (Table 1):

- Approvals: cULus Listed.
Hazardous Locations: Class I; Division 2; Groups A, B, C, D. (See specifications).
- Include the "-C" suffix to specify factory configuration option. Otherwise, no suffix is required for standard configuration.

DESCRIPTION

Series 654T Transmitters are members of the popular Acromag transmitter, isolator, and alarm family. This model is a simple, low cost, dual-channel, two-wire transmitter for multi-range DC voltage input signals, and is fully reconfigurable via external DIP and toggle switches on the module.

This model provides two independent and isolated I/O channels for DC voltage input signals. Front panel toggle switches are used to facilitate field calibration of zero and full-scale. Side access DIP switches select the input range and lock/unlock reconfiguration. The unit may also be calibrated for a normal or reverse acting output response.

The module uses a high resolution, low noise, Sigma-Delta, Analog to Digital Converter ($\Sigma\Delta$ ADC) to accurately convert the input signal into a digitized value. An optically isolated PWM circuit provides the corresponding process current output. These units contain an advanced technology microcontroller with integrated downloadable flash memory and EEPROM for non-volatile program, configuration, calibration, and parameter data storage. Flexible transmitter functionality, variable range inputs, plus convenient switch programming makes this instrument extremely versatile over a broad range of applications.

These modules are designed to withstand harsh industrial environments. They feature RFI, EMI, ESD, EFT, and surge protection, plus low temperature drift, wide ambient temperature operation, and isolation between input and power/output. They also have low radiated emissions per CE requirements.

Units are DIN-rail mounted and removable terminal blocks facilitate ease of installation and replacement, without having to remove wiring. Connectors are an industry standard screw clamp type and accept a wide range of wire sizes.

The safe, compact, rugged, reconfigurable, and reliable design of this transmitter makes it an ideal choice for control room and field applications. Custom module configurations are also possible (please consult the factory).

Key 654T Features

- **Easy Switch Configuration** - The unit is fully configurable via DIP switches. Scaling of the zero and full-scale I/O points is accomplished via front-panel toggle switches. No additional software, adapters, or host computer are required to program this transmitter.
- **Convenient Two-Wire Loop Power** - The output signal and power share the same two-wire connections.
- **Flexible Multi-Range DC Voltage Inputs** - Accepts bipolar and unipolar DC voltage input signals in a variety of ranges.
- **Fully Isolated** - Input and output/power are isolated from each other for safety and increased noise immunity. Units are also isolated channel-to-channel.
- **Normal or Reverse Acting Output Direction** - The output of this transmitter may be configured for a normal acting (ascending), or reverse acting (descending) response.
- **Configuration Lock** - A DIP switch is used to lock and unlock reconfiguration capability of the front panel toggle switches and help prevent inadvertent reconfiguration or tampering in the field. Plastic covers (packaged separately) are also provided to conceal the DIP switches.
- **High-Resolution Precise A/D Conversion** - Transmitters include a high-resolution, low noise, Sigma-Delta Analog to Digital Converter ($\Sigma\Delta$ ADC) for high accuracy and reliability.
- **Automatic Self-Calibration** - Self-calibration is built-in to help correct for temperature drift of the input circuit.
- **Wide Ambient Operation** - The unit is designed for reliable operation over a wide ambient temperature range.
- **Hardened For Harsh Environments** - The unit will operate reliably in harsh industrial environments and includes protection from RFI, EMI, ESD, EFT, and surges, plus low radiated emissions per CE requirements.
- **Convenient Mounting, Removal, & Replacement** - The DIN-rail mount and plug-in type terminal blocks make module removal and replacement easy.

2.0 PREPARATION FOR USE

UNPACKING AND INSPECTION

Upon receipt of this product, inspect the shipping carton for evidence of mishandling during transit. If the shipping carton is badly damaged or water stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is absent when the carton is opened and the contents of the carton are damaged, keep the carton and packing material for the agent's inspection. For repairs to a product damaged in shipment, refer to the Acromag Service Policy to obtain return instructions. It is suggested that salvageable shipping cartons and packing material be saved for future use in the event the product must be shipped.



This module is physically protected with packing material and electrically protected with an anti-static bag during shipment. However, it is recommended that the module be visually inspected for evidence of mishandling prior to applying power.

This circuit utilizes static sensitive components and should only be handled at a static-safe workstation.

INSTALLATION

The transmitter module is packaged in a general purpose plastic enclosure. Use an auxiliary enclosure to protect the unit in unfavorable environments or vulnerable locations, or to maintain conformance to applicable safety standards. Stay within the specified operating temperature range. As shipped from the factory, the unit is calibrated for all valid input ranges, the full input range is scaled to 4 to 20mA at the output, and has the default configuration shown in Table 2 below:

WARNING: Applicable IEC Safety Standards may require that this device be mounted within an approved metal enclosure or sub-system, particularly for applications with voltages greater than or equal to 75VDC or 50VAC.

Table 2: 654T Default Configuration (Each I/O Channel)

PARAMETER	CONFIGURATION/CALIBRATION
Input Range	0 to 10V DC
Reconfiguration Lock	Enabled (Locked)
I/O Scaling (Zero/Full-Scale Configuration)	Input for 4mA Output = 0V; Input for 20mA Output = +10V.

Note: The default configuration noted above corresponds to all DIP switches set to their OFF (open circuit) positions.

Your application may differ from the default configuration noted above and will require that the transmitter be reconfigured to suit your needs. This is accomplished by first setting the DIP switches, then optionally re-scaling your input range to the 4mA and 20mA output range endpoints as described in Section 3.0.

It is generally more convenient to set the DIP switches and configure zero and full-scale prior to completing the installation as described below. Plastic covers (packaged separately) are provided to shield the DIP switches and internal circuit from damage due to electrostatic discharge, debris, or tampering in the field. These covers should be installed after setting the DIP switches and configuring zero and span per your application. As such, you may wish to refer to Section 3.0 at this point to configure the module per your application, before completing installation.

Mounting

Refer to Enclosure Dimensions Drawing 4501-780 for mounting and clearance dimensions.

DIN Rail Mounting: This module can be mounted on "T" type DIN rails. Use suitable fastening hardware to secure the DIN rail to the mounting surface. Units may be mounted side-by-side on 1-inch centers for limited space applications.

"T" Rail (35mm), Type EN50022: To attach a module to this style of DIN rail, angle the top of the unit towards the rail and locate the top groove of the adapter over the upper lip of the rail. Firmly push the unit towards the rail until it snaps solidly into place. To remove a module, first separate the input terminal block(s) from the bottom side of the module to create a clearance to the DIN mounting area. Next, insert a screwdriver into the lower arm of the DIN rail connector and use it as a lever to force the connector down until the unit disengages from the rail.

Electrical Connections

Terminals can accommodate wire from 14-24 AWG, solid or stranded. Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices followed. Input wiring may be shielded or unshielded twisted-pair. Output wires should be twisted pair. Strip back wire insulation 1/4-inch on each lead before installing into the terminal block. It is recommended that output wiring be separated from the input wiring for safety, as well as for low noise pickup. Note that each channel's terminal block is of a plug-in type that can be easily removed to facilitate module removal or replacement, without removing individual wires. To prevent electric shock, be sure to remove the I/O signal before unplugging the terminals to uninstall the module or before attempting service. All connections should be made with I/O signals removed.

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

1. **Input (Each Input):** Connect input(s) per Electrical Connections Drawing 4501-797. Observe proper polarity when making connections.
2. **Output/Power Connections (Each Output):** Connect a DC power supply and load in a two-wire configuration as shown in Electrical Connections Drawing 4501-797. Loop current is input to the OUT+ lead and returned via the OUT- lead. These transmitters operate from DC supplies only. Power supply voltage is not critical and should be from 12-36V DC. Further, the power supply voltage must be adequate to supply full-scale current to the load, plus 12V to the transmitter terminals, plus any transmission line drop. Variations in power supply voltage or load resistance within rated limits has negligible effect on transmitter accuracy.

Ripple & Noise: Power supply ripple at 60Hz/120Hz is reduced at the load by the transmitter. The ripple at the load will generally be less than 0.02% of span per volt peak-to-peak of power supply ripple. You can reduce this ripple by connecting an external 1uF capacitor across the load if desired. For sensitive applications with high-speed acquisition rates, high frequency noise may be reduced by placing a 0.1uF capacitor directly across the load.

Inductive Loads: If the two-wire current loop includes a highly inductive load (such as an I/P transducer), this may reduce output stability. In this case, place a 0.1uF capacitor directly across the inductive load and this will typically cure the problem.

3. **Grounding:** See Electrical Connections Drawing 4501-797. The module housing is plastic and does not require an earth ground connection. If the transmitter is mounted in a metal housing, a ground wire connection is typically required. Connect the metal enclosure's ground terminal (green screw) to earth ground using suitable wire and per applicable codes.

WARNING: For compliance to applicable safety and performance standards, the use of twisted pair wiring is recommended as shown in Drawing 4501-797. Failure to adhere to sound wiring and grounding practices as instructed may compromise safety and performance.

3.0 MODULE CONFIGURATION

This transmitter module needs to be configured for your application. Configuration is accomplished by first setting the DIP switches to select an input range and unlock reconfiguration, then optionally rescaling the input range to the 4-20mA output range endpoints.

All valid input ranges have already been calibrated at the factory. By default, the output 4mA and 20mA range endpoints are factory set to correspond to the full input range endpoints, but may be optionally adjusted to correspond to a portion of the input range as described below. Reconfiguration of transmitter zero and full-scale is accomplished via momentary toggle switches on the front of the module.

DIP SWITCH SETTINGS

Adjacent to the I/O channel terminals are a bank of DIP switches used to select the input range/type and lock/unlock reconfiguration. DIP switch 12 is used to optionally lockout reconfiguration and must be set ON to enable zero and full-scale adjustment. Refer to Drawing 4501-798 and Table 3 below to locate and set these switches as required for your application (shaded entries refer to the factory default configuration). After setting the switches, you will need to configure the zero and full-scale input points via the front panel toggle switches as described below. You should also install the plastic covers (packaged separately) over the DIP switch openings after making your settings (partial enclosure disassembly is required). This helps protect the circuit from penetration by ESD or debris, and prevents tampering in the field.

Table 3A: Input Range Selection - DIP Switch Settings

INPUT RANGE	S1	S2	S3
0-10V ⁴	0	0	0
0-5V ⁴	1	0	0
0-2.5V ⁴	0	1	0
0-1.25V ⁴	1	1	0
±625mV	0	0	1
±313mV	1	0	1
±156mV	0	1	1
±78mV	1	1	1

Table 3B: Miscellaneous Options - DIP Switch Settings

MISCELLANEOUS OPTIONS	S4,5,6,7,8,9,10,11 ³	S12
Configuration Lock OFF	NA	1
Configuration Lock ON	NA	0

Notes (Tables 3A, & 3B):

1. NA = No Application; 0 = Switch Open/OFF; 1 = Switch Closed/ON.
2. The default configuration is all switches OFF (0). This corresponds to the 0-10V input range and zero/full-scale reconfiguration locked out.
3. Note that switches S4-S11 have no function for this model.
4. The unit will permit calibration below 0V, down to -0.65V typical, for these ranges.

These units were packaged with one or more plastic covers for installation over the DIP switch openings. Do not install the DIP switch cover(s) until you have completed the zero and span configuration procedure outlined in the following section. This is done to maintain access to the Configuration Lock switch (SW12), which should be locked following zero and span reconfiguration to help prevent inadvertent miscalibration or tampering in the field.

ZERO AND SPAN CONFIGURATION

IMPORTANT: You must set your DIP switches to select the input voltage range prior to configuring the zero and full-scale input points as described below (see above).

UNLOCK RECONFIGURATION: Reconfiguration is locked out by default and must be unlocked before proceeding. DIP switch 12 must be set ON to allow reconfiguration of zero and full-scale via the front-panel toggle switches.

After setting the DIP switches as required by your application, you may optionally re-scale your input range to the output 4mA and 20mA endpoints as described here. Configuration of the zero & full-scale I/O points (essentially input to output scaling) is accomplished via the transmitter module's "SET/MODE", and "UP/DOWN" toggle switches located on the front panel (see Drawing 4501-798).

Equipment Required

An accurate input voltage source adjustable over the range desired for zero and full-scale is required. For best results, the input source must be accurate beyond the required specifications. Use a voltage source with an output impedance of 100Ω or less. An accurate current or voltage meter is also required to monitor the output level. This meter must also be accurate beyond the module specifications for best results.

Transmitter Zero/Full-Scale Configuration Procedure

CAUTION: Input levels outside of the nominal range of the selected input will not be accepted for configuration of zero or full-scale. Since input levels cannot be validated during field programming, entering incorrect signals may produce an undesired output response.

Note: The transmitter's input range and configuration lock/unlock is set via the DIP switches. Each input range is already factory calibrated and has its full-range endpoints scaled to the 4 to 20mA output by default. However, you may use the front panel toggle switches to scale virtually any part of the nominal input range to the 4-20mA output range. For example, use the 2 to 10V portion of the 0-10V input range to drive the 4 to 20mA output range--this configuration will be used as an example in the following procedure.

Transmitter Zero/Full-Scale Configuration Procedure

1. Set DIP switch 12 of the channel to the ON or "Unlock" position to allow the front panel toggle switches to make adjustments to zero and full-scale.
2. Connect a precision voltage source to the input, as required (refer to Electrical Connections Drawing 4501-797). Connect a current milliammeter (in series with the loop), or voltmeter (across a precision load resistor), to accurately read the output signal. Apply power to the transmitter.
3. Adjust the input source to the zero level (this level must be within the input range selected). For our example: use 2V.
4. If the measured output is not precisely at zero (4.000mA), depress the **Zero "Z"** toggle switch to the **"UP"** or **"DN"** position as required, to precisely adjust the output current to 4.000mA.

Note: The Zero Up/Down toggle functions as a trim adjustment for the zero output loop current level.

Successive depressions of the "UP" or "DN" toggle positions will increment or decrement the output current by a small amount, while holding the toggle switch in the "UP" or "DN" position will increase the amount of increment or decrement.

Reverse Acting Outputs: A reverse acting output can be easily obtained by using the Up/Down toggle to adjust the output level accordingly. For a reverse acting output, you would adjust the zero output level to a higher level here (20.000mA) in response to the zero input, and a lower level (4.000mA) in response to a full-scale input signal (step 6).

5. Adjust the input source to the full-scale level (the input value must be within the input range selected). For our example: use 10V.

Note: The full-scale input value must be greater than the zero input value. If the zero and full-scale points are too close together, performance will be degraded.

6. If the output is not exactly at the full-scale level (20.000mA), press the **Full-Scale "FS"** Up/Down toggle to the **"UP"** or **"DN"** position, as required to precisely adjust the output current to 20.000mA.

Note: The FS Up/Down toggle functions as a trim adjustment for the full-scale output loop current level.

Successive depressions of the "UP" or "DN" toggle positions will increment or decrement the output current by a small amount, while holding the toggle switch in "UP" or "DN" position will increase the amount of increment or decrement.

Reverse Acting Outputs: A reverse acting output can be easily obtained by using the Up/Down toggle to adjust the output level accordingly. For a reverse acting output, you would adjust the output level to a lower level (4.000mA) in response to the full-scale input here, and a higher level (20.000mA) in response to a zero input signal (step 4).

Transmitter Zero/Full-Scale Configuration Procedure

7. After completing zero and full-scale adjustment, be sure to return DIP switch 12 to the down or "Lock" position after waiting at least 15 seconds. This will help prevent inadvertent reconfiguration or tampering in the field by locking out adjustment via the front panel zero and full-scale toggle switches.

IMPORTANT: Note that the zero and full-scale adjustments take effect immediately and are saved to non-volatile memory after 15 seconds of toggle switch inactivity. Please wait the requisite time before powering down or setting DIP switch 12 to the "Lock" position following adjustment or your configuration settings will be lost.

After setting the DIP switches as required by your application and configuring zero and span, be sure to install the plastic cover(s) over the DIP switch openings. To install these covers, you will have to remove the left side cover by prying at each corner with a screwdriver, then sliding the DIP switch covers into the switch opening. Replace the left side cover by snapping it into place and applying pressure at each corner to secure.

4.0 THEORY OF OPERATION

Refer to Simplified Schematic 4501-796 to gain a better understanding of the circuit. A portion of the output loop current is routed to a transformer while being driven in an alternating push-pull fashion to generate an input supply. The remaining output current is pulled through a current steering circuit that regulates the loop current based on an optically coupled input signal. The transmitter will accept a voltage input and scale it to a signal suitable for the A/D converter. The A/D converter stage then applies appropriate gain to the signal, performs analog-to-digital conversion, and digitally filters the signals. The digitized signal is then transmitted serially to a microcontroller. The microcontroller completes the transfer function according to the input range and scaling configuration, and sends a corresponding output signal to an optocoupler and filter circuit. A corresponding analog output voltage is generated and used to drive the amplifier that modulates the loop current. The embedded configuration and calibration parameters are stored in non-volatile memory integrated within the microcontroller.

5.0 SERVICE AND REPAIR

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

SERVICE AND REPAIR ASSISTANCE

This module contains solid-state components and requires no maintenance, except for periodic cleaning and transmitter configuration parameter (zero and full-scale) verification. Since Surface Mounted Technology (SMT) boards are generally difficult to repair, it is highly recommended that a non-functioning module be returned to Acromag for repair. The board can be damaged unless special SMT repair and service tools are used. Further, Acromag has automated test equipment that thoroughly checks and calibrates the performance of each module. Please refer to Acromag's Service Policy Bulletin or contact Acromag for complete details on how to obtain service parts and repair.

PRELIMINARY SERVICE PROCEDURE

Before beginning repair, be sure that all installation and configuration procedures have been followed and that the unit is wired properly. Verify that power is applied and that your power supply voltage is sufficient to supply full-scale current into the load ($0.020 \times R$), plus 12V at the module terminals, plus any line drop. If you continue to have a problem with the unit after making these checks, then an effective and convenient fault diagnosis method is to exchange the questionable module with a known good unit.

Acromag's Application Engineers can provide further technical assistance if required. When needed, complete repair services are available from Acromag.

6.0 SPECIFICATIONS

654T-0600, Dual Channel Voltage Input, 2-Wire Transmitter

General: The Model 654T-0600 2-Wire Transmitter accepts two multi-range voltage input signals, provides input-to-output and channel-to-channel isolation, and generates two, 4 to 20mA, 2-wire output signals. Transmitter channels are independent and isolated, and connected in two-wire fashion, with the output signal and power sharing the same leads. These transmitters are DIN-rail mounted with plug-in type terminal blocks. Units are fully configured via DIP switches and front-panel toggle switches. Non-volatile reprogrammable memory within the module stores calibration and configuration information.

MODEL NUMBER DEFINITION

Transmitters are color coded with a white label. The prefix "6" denotes the Series 600 family of transmitters and isolators, while the "T" suffix specifies that this device is primarily a process transmitter.

654T: Dual Channel Voltage Input, 2-Wire Transmitter

-0600: The four digits of this model suffix represent the following options, respectively:

- 0 = Option specifier - no option for this model;
 - 6 = Output is DC current;
 - 0 = Enclosure is DIN rail mounted;
 - 0 = Approvals: cULus Listed, UL file E199702 & E202242.
- Hazardous Locations: Class I; Division 2; Groups A, B, C, D.

INPUT SPECIFICATIONS

Unit must be wired and configured for the intended input range (see Installation Section for details). The unit can be configured to accept voltages within any of the input ranges described below via the DIP switches. The toggle switches are used to scale the input to the 4-20mA output. The following paragraphs summarize this module's input ranges and applicable specifications.

DC Voltage: User-configured for the following DC voltage ranges: $\pm 78\text{mV}$, $\pm 156\text{mV}$, $\pm 313\text{mV}$, $\pm 625\text{mV}$, 0-1.25V, 0-2.5V, 0-5.0V, and 0-10.0V. Note that the unit will permit calibration below 0V, down to -0.65V typical, for the 0-1.25V, 0-2.5V, 0-5V, and 0-10V ranges.

Voltage Input Reference Test Conditions: $\pm 78\text{mV}$ input range configured with a 50mV span; Ambient Temperature = 25°C ; Power Supply = 24V DC; R-load=500 Ω .

Input Impedance: 110K Ω typical.

General Input Specifications

Accuracy: Better than $\pm 0.1\%$ of span, typical. This includes the effects of repeatability and terminal point conformity, but does not include sensor error.

Resolution: Effective resolution is controlled by the output stage which resolves to 1 part in 6546 for the nominal 4 to 20mA output span.

Response Time: 980ms typical, for an analog output to reach 98% of the final value for a step change in input.

Input Filter Bandwidth: -3dB at 3Hz, typical.

Input bias current: 25nA typical.

Noise Rejection (Normal Mode): Better than 40dB @ 60Hz, typical with 100 Ω input unbalance.

Noise Rejection (Common Mode): Better than 140dB @ 60Hz, typical with 100 Ω input unbalance.

Analog to Digital Converter (A/D): A 16-bit Σ - Δ converter.

Input Conversion Rate: Every 50ms or 20 conversions per second.

Input Filter: Normal mode filtering, plus digital filtering optimized and fixed per input range within the Σ - Δ ADC.

OUTPUT SPECIFICATIONS

DC Process Current Output Specifications:

Output Range: 4 to 20mA DC, 3.8 to 23.8mA range typical.

Output Ripple: Less than $\pm 0.1\%$ of output span.

Output Limiting: Output current is limited to less than 25mA, typical.

Output Maximum Current: 23.8mA typical, 25mA maximum.

Output Compliance: 11V Minimum, 12V Typical.

Output Resolution: The output stage resolves to 1 part in 6546 for a 4 to 20mA output span.

General Output Specifications:

Response Time: For a step change in input voltage, the output reaches 98% of its final value in less than 980ms typical, with a 500 Ω load. Response time will vary with load resistance.

Accuracy: Better than $\pm 0.1\%$ of output span ($\pm 16\mu\text{A}$) typical. This error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity, and adjustment resolution. It does not include sensor error.

Accuracy Versus Temperature: Better than $\pm 0.010\%$ of input span per $^\circ\text{F}$ ($\pm 0.018\%$ per $^\circ\text{C}$ or $\pm 180\text{ppm}/^\circ\text{C}$) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span drift over temperature.

Output Power Supply: 12-36V DC Class 2, 24mA. The supply voltage must be chosen to provide full-scale current to the load ($0.020 \times R$), plus 12V to the isolator terminals, plus any line drop. Reverse polarity protection is included.

Power Supply Effect: Less than $\pm 0.001\%$ of output span effect per volt DC change, or $\pm 0.015\%$ of output span effect per volt peak-to-peak of 60Hz/120Hz power supply ripple.

Output Load Resistance Effect: Less than $\pm 0.01\%$ of output span effect for $\pm 100\Omega$ change in load resistance.

Load Resistance Range Equation: R_{load} (Maximum) = $(V_{\text{supply}} - 12\text{V}) / 0.020\text{A}$ (assuming negligible line drop). At a 24V DC supply, $R_{\text{load}} = 0-600\Omega$.

Note: For sensitive applications with high-speed acquisition rates, high frequency noise may be reduced by placing a 0.1 μF capacitor directly across the load.

Output Conversion Rate: Every 50ms or 20 conversions per second.

APPROVALS (-xxx0)

0: cULus Listed
Hazardous Locations: Class I; Division 2; Groups A, B, C, D.

ENCLOSURE/PHYSICAL SPECIFICATIONS

Unit is packaged in a general purpose plastic enclosure that is DIN rail mountable for flexible, high density (approximately 1" wide per unit) mounting. See Enclosure Dimensions Drawing 4501-780 for details.

Dimensions: Width = 1.05 inches, Height = 4.68 inches, Depth = 4.35 inches (see Drawing 4501-780).

DIN Rail Mounting (-xx0x): DIN rail mount, Type EN50022; "T" rail (35mm).

Connectors: Removable plug-in type terminal blocks; Current/Voltage Ratings: 15A/300V; Wire Range: AWG #14-24 solid or stranded; Separate terminal blocks are provided for each I/O channel.

Case Material: Self-extinguishing NYLON type 6.6 polyamide thermoplastic, UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Printed Circuit Boards: Military grade FR-4 epoxy glass.

Shipping Weight: 1 pound (0.45 Kg) packed.

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature: -25°C to +75°C (-13°F to +167°F), Temperature Code: T4.

Storage Temperature: -40°C to +85°C (-40°F to +185°F).

Relative Humidity: 5 to 95%, non-condensing.

Isolation: Inputs, outputs, and channels are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). This complies with test requirements outlined in ANSI/ISA-82.01-1988 for the voltage rating specified.

Installation Category: Designed to operate in an Installation Category for use in pollution degree 2..

Radiated Field Immunity (RFI): Designed to comply with IEC1000-4-3 Level 3 (10V/M, 80 to 1000MHz AM & 900MHz keyed) and European Norm EN50082-1.

Electromagnetic Interference Immunity (EMI): No output shift will occur beyond $\pm 0.25\%$ of span, under the influence of EMI from switching solenoids, commutator motors, & drill motors.

Electrical Fast Transient Immunity (EFT): Complies with IEC1000-4-4 Level 3 (2KV) and European Norm EN50082-1.

Electrostatic Discharge (ESD) Immunity: Complies with IEC1000-4-2, Level 3 (8KV/4KV air/direct discharge) to the enclosure port and European Norm EN50082-1.

Surge Immunity: Complies with IEC1000-4-5 Level 3 (2.0KV) and European Norm EN50082-1.

Radiated Emissions: Meets or exceeds European Norm EN50081-1 for Class B equipment.

IMPORTANT: Power, input, and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods Article 501-4(b) of the National Electrical Code, NFPA 70 for installations in the U.S., or as specified in section 18-1J2 of the Canadian Electrical Code for installations within Canada and in accordance with the authority having jurisdiction.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D, or non-hazardous locations only.

WARNING – EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2.

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

CAUTION – To reduce the risk of fire or electric shock, do not interconnect the outputs of different class 2 circuits.

CONFIGURATION CONTROLS

Configuration of this transmitter is accomplished via external DIP switches and toggle switches provided for each channel and described below:

Toggle Switches (Each Channel, See Drawing 4501-798):

The following SPDT toggle switches are used to configure the transmitter's zero and full-scale end points (input to output scaling) and are located on the front panel. Adjustment via these switches may be locked out via DIP switch 12 (see below).

Z (Zero) Up/Down - Used to adjust the **Zero** endpoint during field configuration. With a zero input signal applied, depress this toggle to the UP direction to raise the output zero level, or DN to lower the output zero level.

FS (Full-Scale) Up/Down - Used to adjust the **Full-Scale** endpoint during field configuration. With the full-scale input signal applied, depress this toggle to the UP direction to raise the full-scale output level, or DN direction to lower the full-scale output level.

DIP Switches (See Drawing 4501-798 For Location):

Options Configuration - Used to select the input range and lock or unlock reconfiguration. Refer to Drawing 4501-798 and INSTALLATION section to set switches. Note that switches 4-11 are non-functional for this model.

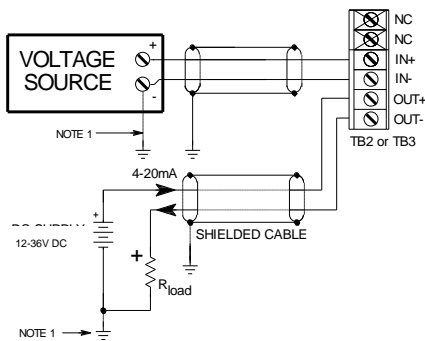
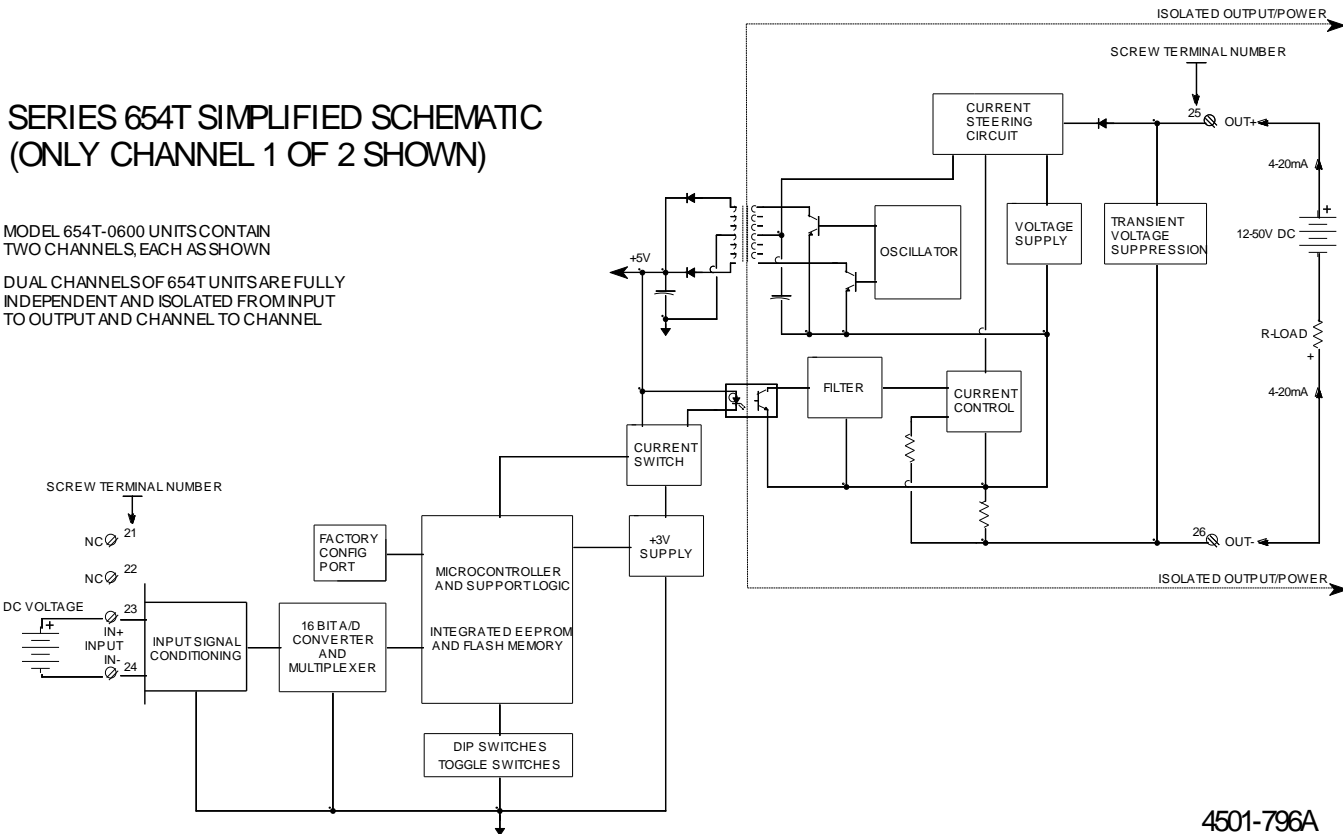
Input - Range (S1-3): The transmitter can be configured to accept any one of eight voltage ranges. Input ranges are already factory calibrated.

Unlock Reconfiguration (S12): This switch is normally enabled (locked) and must be set ON to unlock zero/full-scale reconfiguration capability of the front panel toggle switches. It is provided as an extra level of security to help prevent inadvertent reconfiguration or tampering in the field.

SERIES 654T SIMPLIFIED SCHEMATIC
(ONLY CHANNEL 1 OF 2 SHOWN)

MODEL 654T-0600 UNITS CONTAIN
TWO CHANNELS, EACH AS SHOWN

DUAL CHANNELS OF 654T UNITS ARE FULLY
INDEPENDENT AND ISOLATED FROM INPUT
TO OUTPUT AND CHANNEL TO CHANNEL

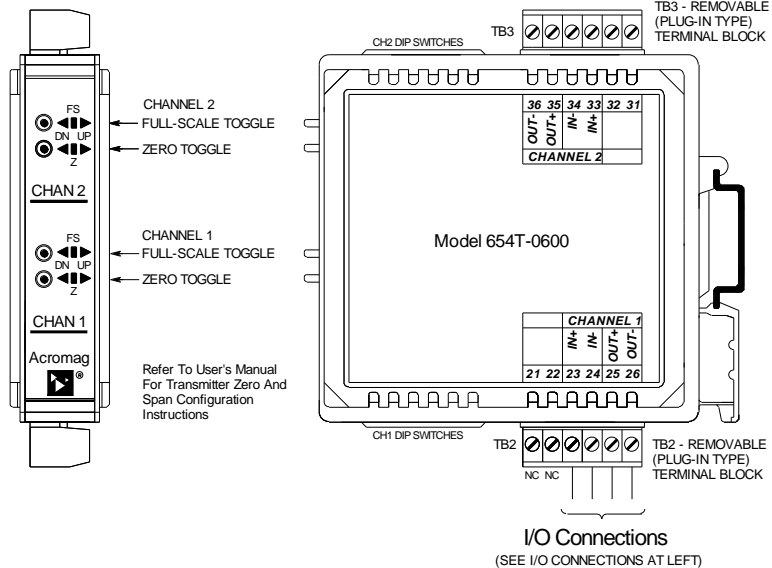


NOTE 1: THIS GROUND CONNECTION IS RECOMMENDED FOR BEST RESULTS.
IF SENSORS ARE INHERENTLY CONNECTED TO GROUND, USE CAUTION AND
AVOID MAKING ADDITIONAL GROUND CONNECTIONS WHICH COULD GENERATE
GROUND LOOPS AND MEASUREMENT ERROR.

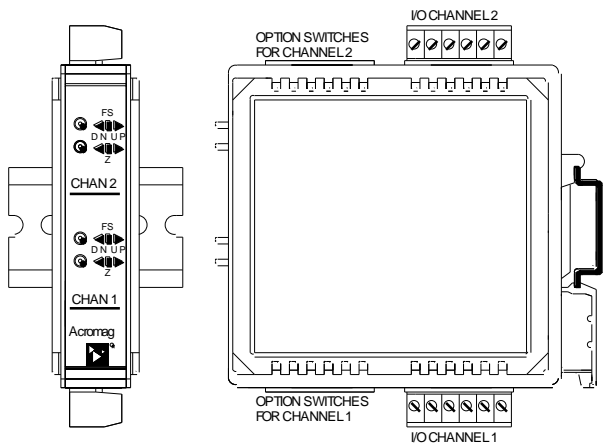
ELECTRICAL CONNECTIONS
MODEL 654T-0600

WARNING:
FOR COMPLIANCE TO APPLICABLE SAFETY AND PERFORMANCE STANDARDS,
THE USE OF SHIELDED CABLE IS RECOMMENDED AS SHOWN. ADDITIONALLY,
THE APPLICATION OF EARTH GROUND MUST BE IN PLACE AS SHOWN IN THIS
DRAWING. FAILURE TO ADHERE TO SOUND WIRING AND GROUNDING
PRACTICES MAY COMPROMISE SAFETY AND PERFORMANCE.
SAFETY GUIDELINES MAY REQUIRE THAT THIS DEVICE BE HOUSED IN AN
APPROVED METAL ENCLOSURE OR SUB-SYSTEM, PARTICULARLY FOR
APPLICATIONS WITH VOLTAGES GREATER THAN OR EQUAL TO 75VDC/50VAC.

MODEL 654T-0600 SHOWN



4501-797B



DIP SWITCH SETTINGS

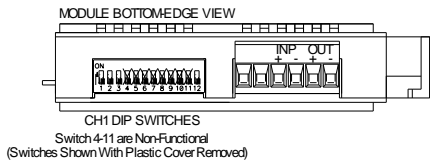
SWITCHES 4-11 ARE NOT USED

RECONFIGURATION LOCK/UNLOCK

1 = ON (Closed)
0 = OFF (Open)

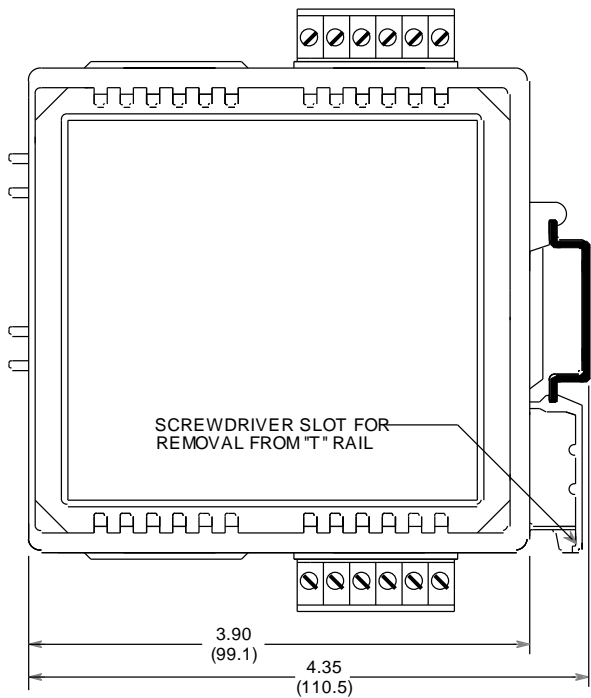
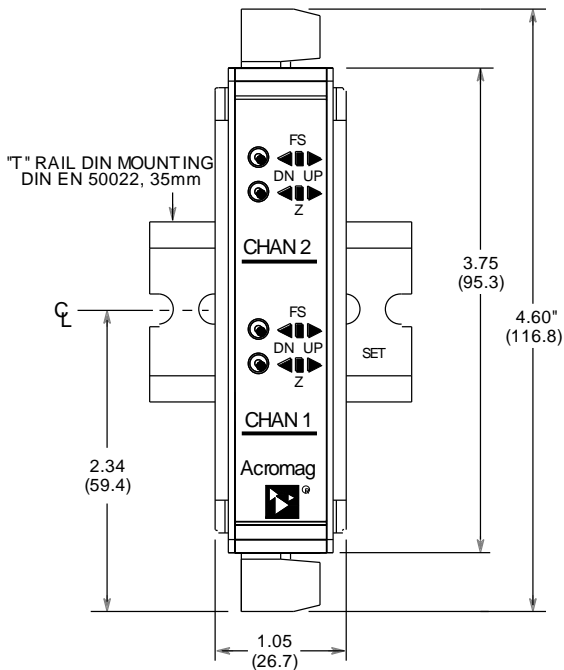
DEFAULT CONFIGURATION
(All Switches OFF)
0V to +10V DC
Lock ON

SWITCH POSITION	1	2	3	4	5	6	7	8	9	10	11	12	
0-10V	0	0	0									1	Configuration UNLOCKED
0-5V	1	0	0									0	Configuration LOCKED
0-2.5V	0	1	0										
0-1.25V	1	1	0										
+/-625mV	0	0	1										
+/-313mV	1	0	1										
+/-156mV	0	1	1										
+/-78mV	1	1	1										



MODEL 654T-0600 DIP SWITCH SETTINGS

4501-798A



NOTE: ALL DIMENSIONS ARE IN INCHES (MILLIMETERS)

MODEL 65xT-0600 ENCLOSURE DIMENSIONS
(MODEL 655T-0600 & 657T-0600 ARE SIMILAR, BUT ONLY CHANNEL 1 IS PRESENT)

4501-780A

REVISION HISTORY

The following table details the revision history for this document:

Release Date	Version	EGR\DOC	Description of Revision
3-AUG-2017	H	CAP/JAA	Remove CE Mark due to non-RoHS compliant part. Refer to ECN# 17G016.

Notes: