

421/422 FAMILY
OF
ISOLATING SIGNAL CONDITIONERS

421i / 422i / 421Tx / 422Tx

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1.0 INTRODUCTION

The 421/422 family provide 2KV RMS galvanic isolation for 4 - 20mA process loops without requiring a separate power supply connection.

The family comprises two basic models, the first providing low voltage drop, high accuracy isolation from an existing loop, the second providing isolated power to a two wire transmitter.

Each model is available in single or dual current form as indicated by the part number. This information, together with a unique serial number, is printed on the side label of each unit; records of the exact configuration of every product shipped are maintained at the factory.

1.1 Members Of The Family

421i

The 421i provides 1 to 1 galvanic isolation of DC currents between 0 and 50 mA, covering the standard 0 - 20 mA and 4 - 20mA ranges as well as 0 - 1mA, 0 - 5mA and 0 - 10mA, with the accuracy specified in section 7. There are no adjustment potentiometers on the 421i, accuracy being inherent in the circuit design.

The output signal is always proportional to the input signal - i.e. no offset can be added or subtracted.

The maximum loop resistance that can be driven by the 421i and the maximum voltage drop of the 421i itself are as follows:

Full Scale Input/mA	Max load resistance/ Ω	Max voltage drop /V
1	13,500	1.5
5	2,800	1.8
10	1,450	2.0
20	720	2.5
50	250	4.5

The 421i is typically connected as shown in figure 1.

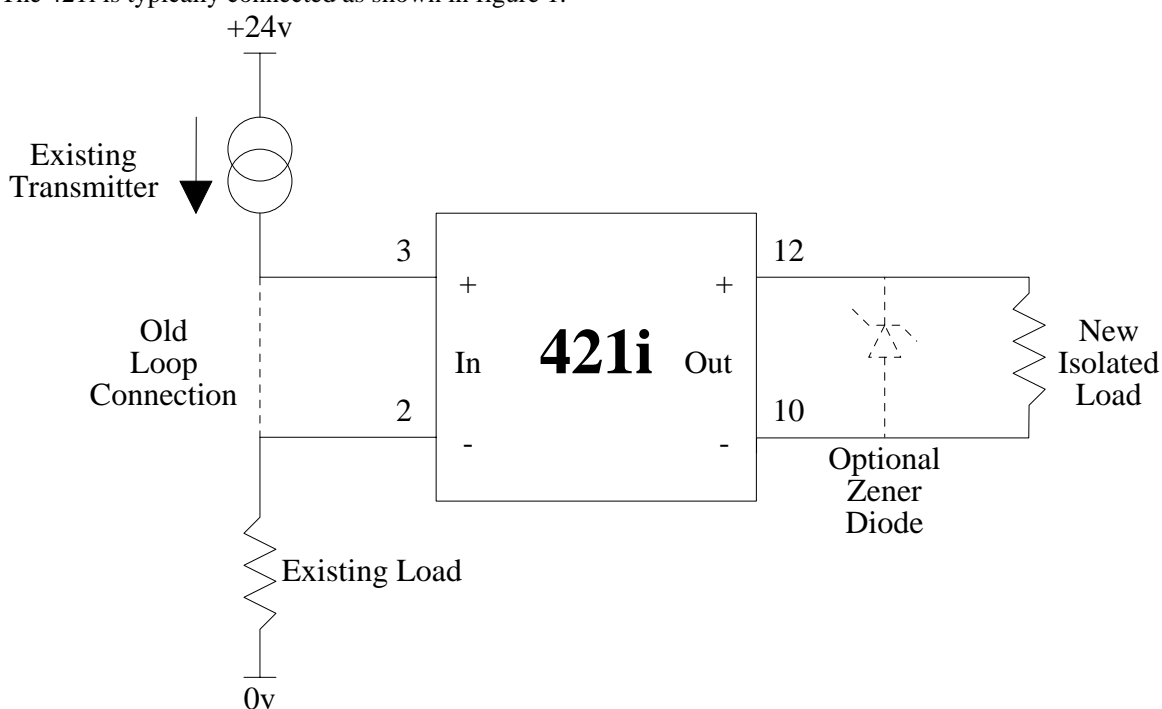


Figure 1 - Typical 421i Connection

The voltage dropped across the 421i's input terminals is equal to the volt drop across the isolated load plus the isolator volt drop from the above table.

Note a: It is important to make sure that, at full current, there is still sufficient voltage across the transmitter for it to function correctly.

Note b: Since the 421i is effectively a DC transformer, removing the isolated load will break the loop. (It is exactly the same as if the new load was connected in place of the old loop connection - take it out and there is no circuit).

If it is required to connect the isolated load on an ad hoc basis then a Zener diode, of voltage rating just higher than the load voltage at full current, can be connected, as shown, to preserve loop continuity when the load is disconnected.

422i

The 422i is a dual channel version of the 421i, in the same enclosure, with identical performance for each channel.

421Tx

The 421Tx is typically connected as shown in figure 2.

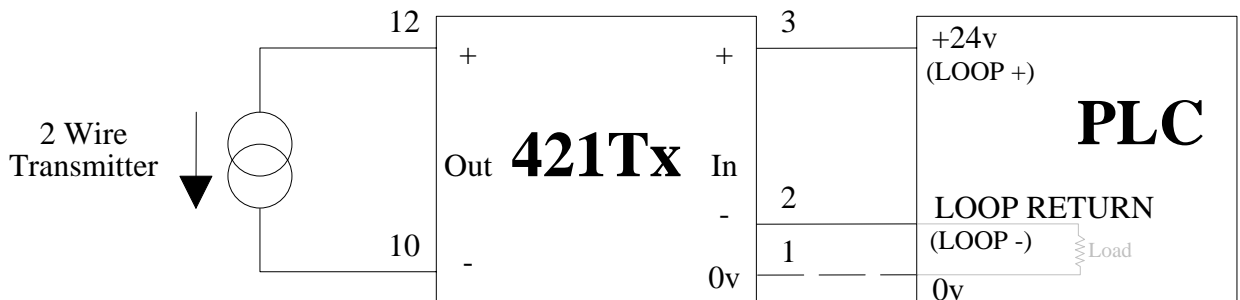


Figure 2 - Typical 421Tx Connection

Here the device on the right (typically a controller) has loop + and loop - terminals to which a two wire transmitter is to be connected. The 421Tx is used to electrically isolate the transmitter whilst still ensuring that the correct current flows in the loop. There is a small inherent offset produced by this technique, whereby the current flowing in the controller loop is slightly higher than that in the transmitter. Ideally the optional OV connection (shown as dotted line) should be made to remove this offset. If the OV is not available then the transmitter 'Zero' potentiometer can be adjusted to cancel the effect of the offset in the controller loop.

The maximum voltage drop across the device at 20mA is 3.5 V - i.e. voltage across terminals 10 & 12 (transmitter) is 3.5 V less than voltage across terminals 2 & 3 (controller loop). The supply voltage (which should not exceed 28V) and loop load should be chosen such that the transmitter has sufficient voltage across it to function correctly at full current.

422Tx

The 422Tx is a dual channel version of the 421Tx, in the same enclosure, with identical performance for each channel.

2.0 UNPACKING

Please inspect the instrument carefully for signs of shipping damage. The unit is packed to give maximum protection but we can not guarantee that undue mishandling will not have damaged the instrument. In the case of this unlikely event, please contact your supplier immediately and retain the packing for our subsequent inspection.

2.1 Checking the Unit Type

Each unit has a unique serial number label (fig. 1 below) on which full details of the configuration are given. These details should be checked to ensure conformance with your requirement.



 Industrial Interface		
PART NUMBER	421i	
INPUT	0(4)-20mA	
OUTPUT	0(4)-20mA	
SUPPLY	LOOP	
OPTIONS		
NATO STOCK No.		
SERIAL No.	I193-345	

Fig. 3 - Serial Number Label

421/422 CONNECTION DETAILS	
Channel 1 -	
2. Input -ve	10. Output -ve
3. Input +ve	12. Output +ve
1. Input 0v (optional)	
Channel 2 -	
5. Input -ve	7. Output -ve
6. Input +ve	9. Output +ve
4. Input 0v (optional)	

Fig. 4 - Connection details

3.0 CONNECTIONS

This section details the instrument connection information. Before proceeding, please check the information on the serial number label on one side of the unit to ensure that the unit configuration is correct. Connection details are given on the connections side label shown in fig. 4 above. For 421i and 421Tx, only channel 1 connections are appropriate.

3.1 Maximum Signal Ratings

421i/422i

Input current should not exceed 50mA; otherwise damage to the unit may result. The 421i/422i are unipolar devices - i.e. input and output do not respond to negative signals. However reverse polarity connection will not damage the unit provided the maximum current criterion is not exceeded.

IMPORTANT: Do not apply low impedance voltage signals to input or output otherwise damage will result. (e.g. 24V DC supply).

421Tx/422Tx

Input / loop voltage should not exceed 28V. Exceeding this limit will result in inaccuracy and possible damage to the unit. (The unit does however include a resetting fuse which will prevent a damaged unit from pulling down the loop supply, and protect the unit in case of reverse polarity connection).

The two wire transmitter should not draw more than 50mA from the output, or damage may result.

4.0 RECALIBRATION

421 and 422 series units are not recalibrateable but have their test data recorded at the factory.

5.0 INSTALLATION

Installation Data _____

Mounting	DIN Rail T35
Orientation	Any (Vertical Preferred)
Connections	Screw Clamp With Pressure Plate
Conductor Size	0.5mm - 4.0 mm
Insulation Stripping	10mm
Screw Terminal Torque	0.4Nm Max.
Weight	100g (approx.)
Depth Of Unit	100mm

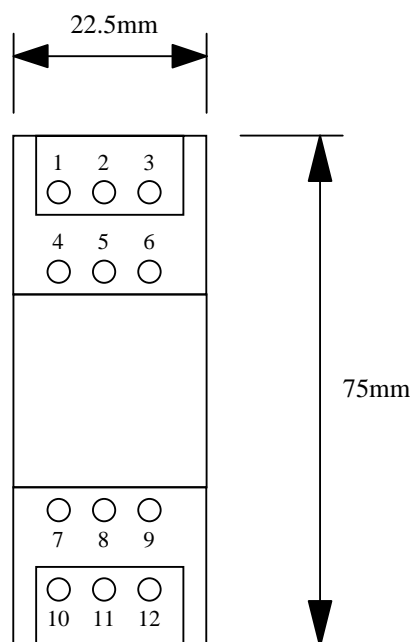


Figure 5 - Installation Data & Terminal Positions For 421/422 Series

5.1 Installation onto Rails

The instrument is designed to mount directly onto the 'Top hat' TS35 standard assembly rail to DIN 46277 part 3/EN 50022/BS5584.

5.2 Mounting Arrangements

Ideally the unit should be mounted in a vertical position, i.e. on a horizontal rail. This is the optimum orientation to minimise temperature rise within the unit. However successful operation is possible in any orientation.

Ensure the maximum ambient temperature is less than 70°C.

Good airflow around the unit will maximise reliability.

5.3 Wiring Precautions

The unit can accept a variety of sensor inputs, some of which produce very small signals. Therefore it is advisable to adhere to the following rules of good installation practice.

- (i) Do not install close to switchgear, electromagnetic starters, contactors, power units or motors.
- (ii) Do not have power or control wiring in the same loom as sensor wires.
- (iii) Use screened cable for sensor wiring with the screen earthed at one end only.
- (iv) Take care not to allow cut pieces of wire to fall onto the unit as they might enter via the ventilation holes and cause electrical short circuits. If in doubt, remove the units from the rail until wiring is complete.
- (v) Use bootlace ferrules on all bare wires.

IMPORTANT: The connection terminals are designed for a maximum torque of 0.4Nm. Exceeding this figure is unnecessary and will result in unwarrantable damage to the unit.

6.0 SPECIFICATIONS

All specifications are at 20°C operating ambient unless otherwise stated.
Supply voltage for 421/422Tx is 24V DC.

Accuracy and Response

421i

Maximum output current error 0 - 20mA into 250 Ω	20µA
Linearity	+/- 0.1% full scale
Output current variation with load resistance, R _L (20mA input)	-100nA/ Ω max, 0 ≤ R _L ≤ 600Ω
Response Time (90% of step change)	40ms typical
Max Input Voltage drop (20mA input, R _L = 0)	2.5V
Temperature coefficient of output (20mA input)	90ppm / °C max

422i

As above

421Tx

Input offset error at 12mA(into 250Ω - OV not connected)	+0.45% full scale max*
Linearity	+/- 0.15% full scale
Input current variation with load resistance, R_L (20mA output)	-100nA/Ω max, $0 \leq R_L \leq 600 \Omega$
Response time (90% of step change)	60ms typical
Max output voltage drop (20mA output)	3.5V
Temperature coefficient of input (20mA output)	90ppm/°Cmax

Isolation and operating Ambient (all types)

Input to output isolation	2kV RMS DC
Operating temperature range	-15 - 70°C
Storage temperature range	-40 - 100°C
Operating and storage humidity range	0 - 90% RH

6.1 EMC performance

The 421i, 422i, 421Tx and 422Tx all conform with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of member states relating to electromagnetic compatibility (Article 10 (1)):

1) Radiated Emissions:

The units meet EN55011: 1991 (Group 1,ClassB) and EN55022: 1987 (Class B)

2) EMC Immunity:

The units meet EN50082-2: 1995 as follows:

(i) ESD Immunity:

Performance is not degraded by 8KV ESD to ground in the vicinity of the units. Direct ESD greater than 4KV to the connection terminals of the units should be avoided.

IMPORTANT:

Service/ Maintenance personnel should take care to discharge themselves to the control cabinet/ systems earth before wiring or servicing the units.

(ii) RF Immunity:

The output of the units varies by less than +/- 0.5% full scale with fields of 10 Vm^{-1} with 80% A.M. at 1KHz, between 800KHz and 1GHz with any field orientation.

(iii) Fast Transient Immunity:

During transients of 2 KV the outputs vary by less than 0.5% full scale.

Hence the units are suitable for both 'Light industrial' and 'Industrial' environments.

* Input offset error reduced to zero by OV connection