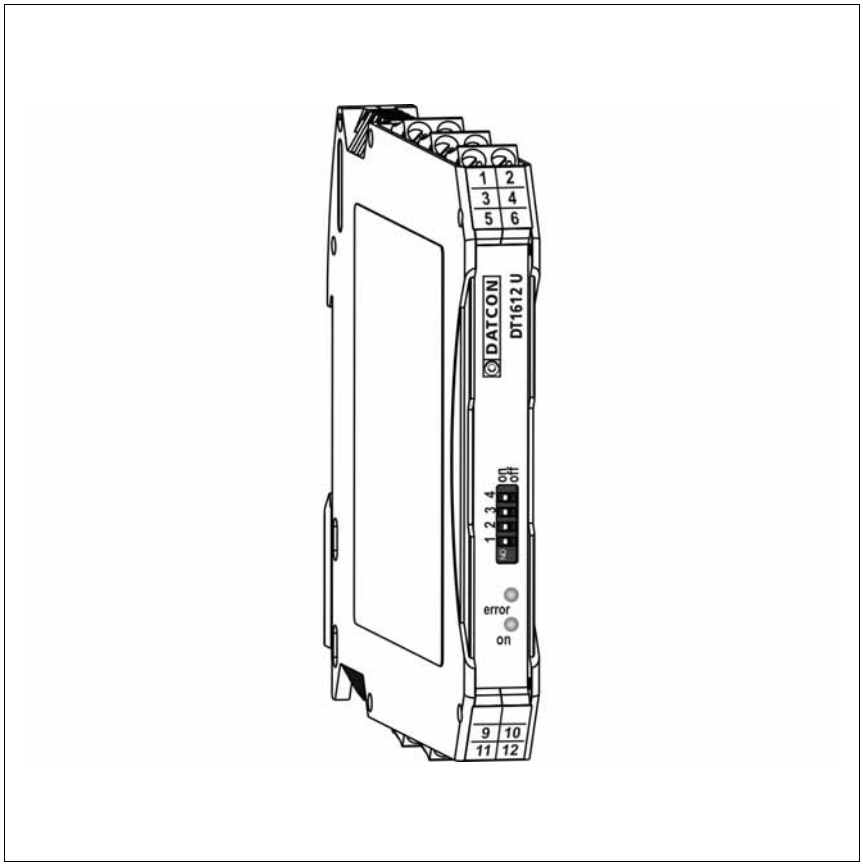
DATCON
IPARI ELEKTRONIKAI KFT.

DT1612 U (PS)

AC Voltage Transmitters with analog output

Operating Instructions



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1. About this document

1.1. Function

This operating instructions manual has all the information you need for quick set-up and safe operation of
DT1612 U (PS).
Please read this manual before you start setup.

1.2. Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them

1.3. Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution, warning, danger
This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.

List
• The dot set in front indicates a list with no implied sequence.

Action
→ This arrow indicates a single action.

Sequence
1 Numbers set in front indicate successive steps in a procedure.

2. For your safety

2.1. Authorized personnel

All operations described in this operating instructions manual must be carried out only by trained and authorized specialist personnel. For safety and warranty reasons, any internal work on the instruments must be carried out only by DATCON personnel

2.2. Appropriate use

The DT1612 U AC Voltage Transmitters with analog output
Detailed information on the application range is available in **Chapter 3. Product description.**

2.3. Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, or damage to system components through incorrect mounting or adjustment.

2.4. General safety instructions

The DT1612 U is a high-tech instrument requiring the strict observance of standard regulations and guidelines.

The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

2.5. CE conformity

The DT1612 I is in conformity with the provisions of the following standards:
EN 61326-1 (EMC)
EN 61010-1 (safety)

2.6. Environmental instructions

Protection of the environment is one of our most important duties. Please take note of the instructions written in the following chapters:

- Chapter **3.6. Storage and transport**
- Chapter **7.2. Disposal**

3. Product description

3.1. Delivery configuration

A szállítás tárgya

The scope of delivery encompasses:

- DT1612 U (PS)
- switch adjustment tool (in the case of simultaneous shipment of multiple units, only one tool is included in the shipment)
- dokumentation:
  - This operating instructions manual
  - Certification,
  - warranty

3.2. Type designation

DT1612 U	24 VDC supply voltage
DT1612 U PS	230 V AC/DC supply voltage

3.3. Principle of operation

Area of application

A DT1612 U (PS) AC Voltage Transmitters with analog output produce an output signal proportionally with the TRMS value of the input AC voltage.

The output can be a current (0–20 mA, 4–20 mA, or a voltage (0–10 V, 2–10 V). (Only one output can be used at same time!)
The measuring ranges (125 V / 250 V / 450 V) and the type of output signal can be selected using the SİP switch on the front panel.

The measuring range U = 125 V can be expanded as desired trough a voltage transformer.

The input, the output and power supply are galvanic isolated from each other. The measuring input is suitable for measurement at CAT.III category.

Operating principle

The AC voltage connected to the input is led through voltage divider to the AD converter inputd. The AD resulution is 24 bits. Fs = 1,1 MHz.

The signal from the A/D converter is received by the device's microcontroller, which performs the TRMS conversion. The microcontroller generates the PWM signal for the output stage. The PWM signal controls the input of the output stage via an optocoupler.
The output stage generates a DC current / DC voltage proportional to the PWM signal.

Power supply

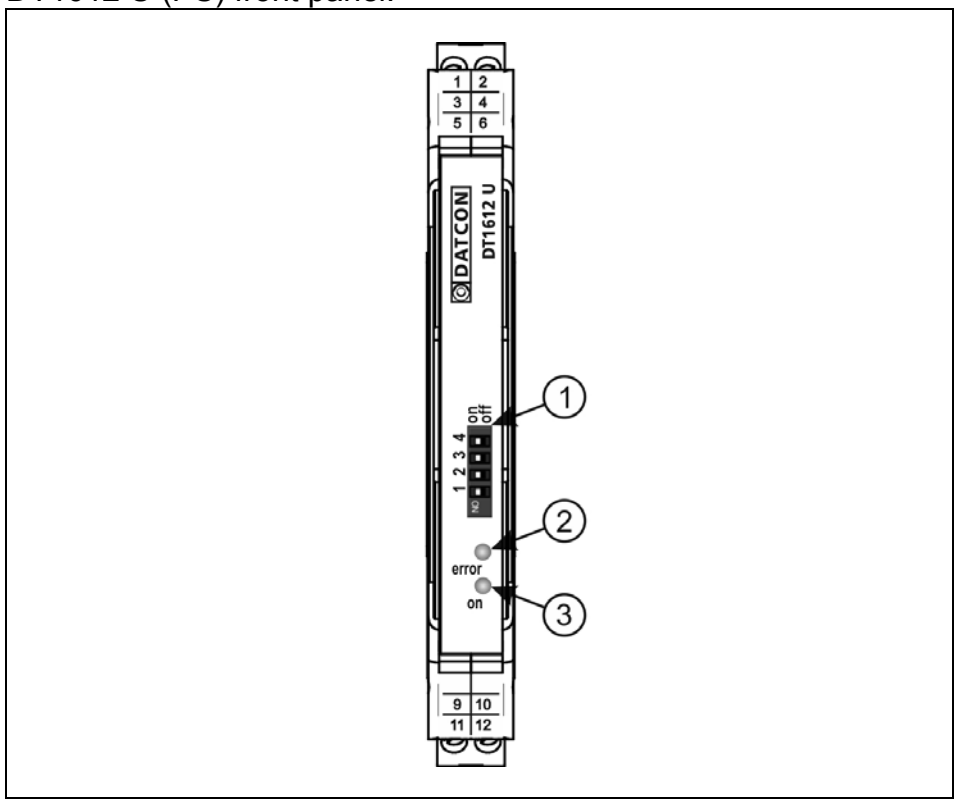
There are two power supply versions:
DT1612 U:
Power supply: 24 VDC ±10%
DT1612 U PS:
Power supply: 230 V AC/DC ±10%
The overcurrent protection in installation is 4 A (B).

3.4. Adjustmnet

The DT1612 U (PS) doesn't need any adjustment.
After connected to the power supply it is ready to work.

3.5. Indicator

The following figure shows the indicator on the DT1612 U (PS) front panel.



(1) signal type selector (configuration) switches
(2) The red „error" indicator shows the errors states.
(3) The power green „on" indicator shows that the instrunment is in "power on" state.

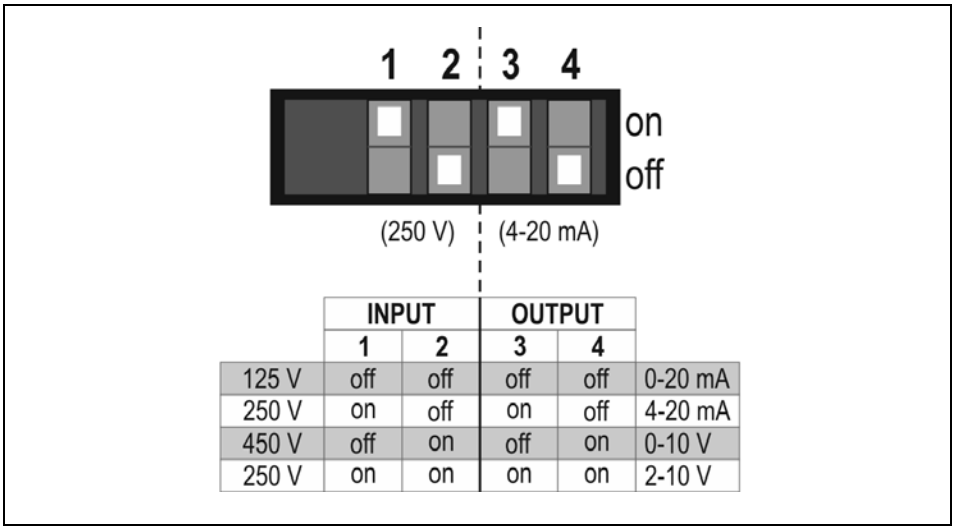
3.6. Signal type selector with configuration switches

Three signal ranges can be selected at the input and four at the output using the front panel switches.

At the input:
0-125 VAC, 0 – 250 VAC, 0 – 400 VAAC,
At the output:
0–20 mA, 4–20 mA, 0–10 V, 2–10 V

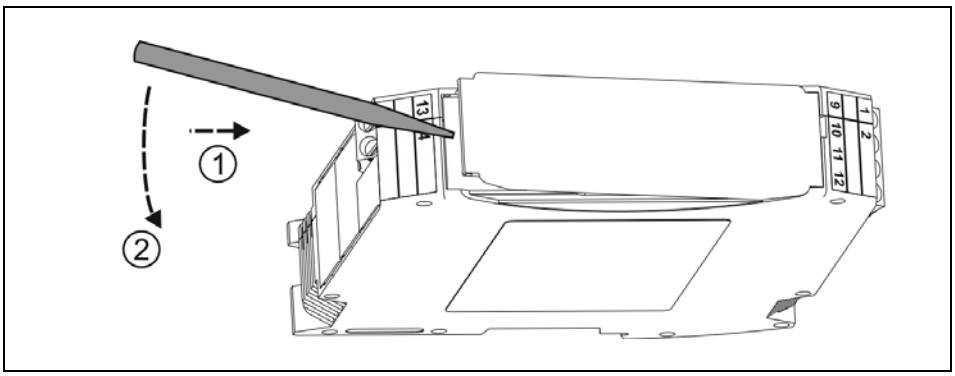
The factory default setting is:
0 – 125 VAC input and 0 – 20 mA output
(all switches are in the “off” position).

The following figure shows the front panel of the device and the settings of the front panel switches according to the signal types:

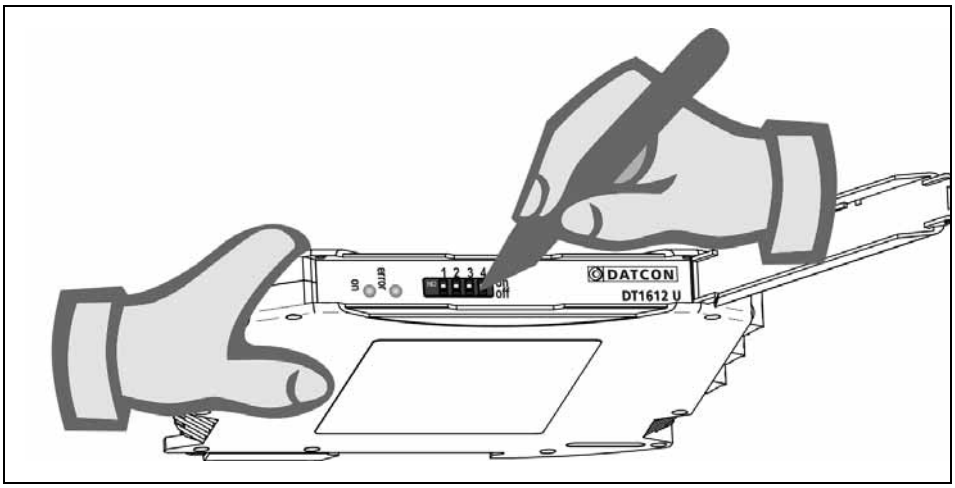


	INPUT		OUTPUT		
	1	2	3	4	
125 V	off	off	off	off	0-20 mA
250 V	on	off	on	off	4-20 mA
450 V	off	on	off	on	0-10 V
250 V	on	on	on	on	2-10 V

The following two figures show the setup process:



1. Hold the device in the position as shown in the figure.
2. Unclip the transparent front cover at the gap above the 13-14 labels using the switch adjustment tool. Open the cover by hand to allow easy access to the switches.



3. Set the desired input and output signal levels according to the table shown above.
4. Use your index finger to fold back the transparent protective cover until it snaps back into its closed position.

Do not use any other tools as this may damage the switch and/or the front panel.

3.7. Storage and transport

This instrument should be stored and transport in places whose climatic conditions are in accordance with chapter **10.1 Technical specifications,** as described under the title: Environmental conditions.

The packaging of DT1612 U (PS) consist of environment-friendly, recyclable cardboard is used to protect the instrument against the impacts of normal stresses occurring during transportation. The corrugated cardboard box is made from environment-friendly, recyclable paper. The inner protective material is nylon, which should be disposed of via specialized recycling companies.

4. Mounting

4.1. General instructions

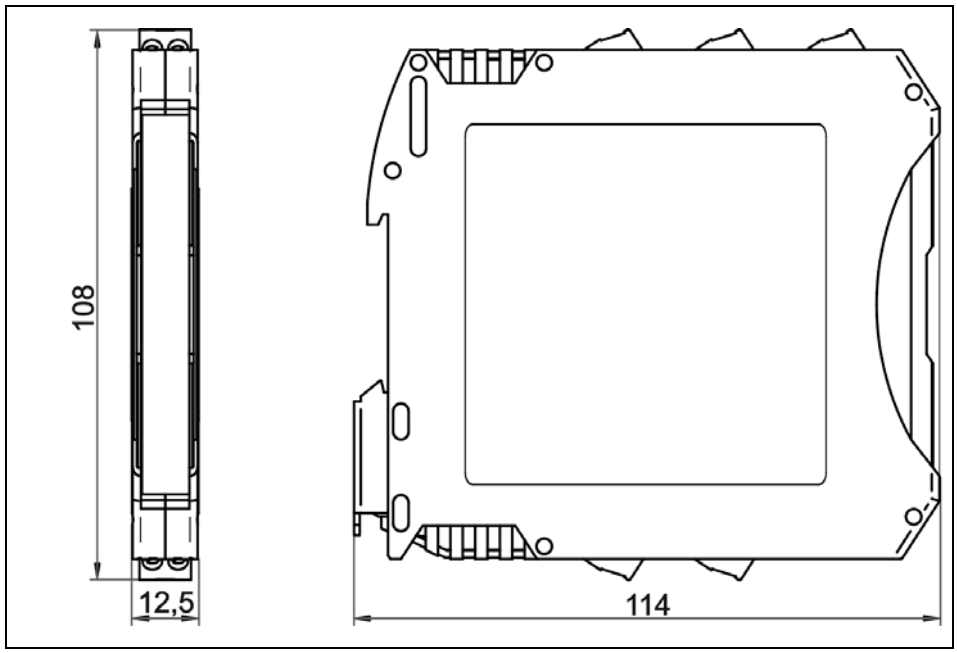
The instrument should be installed in a cabinet with sufficient IP protection, where the operating conditions are in accordance with chapter **10.1 Technical specifications**, as described under the title: Operating conditions.

Mounting position

The DT1612 U (PS) is built in a plastic housing, for mounting on TS-35 rail.
The instrument should be mounted in vertical position (horizontal rail position).

Horizontal mounting may cause overheating and damage of the instrument.

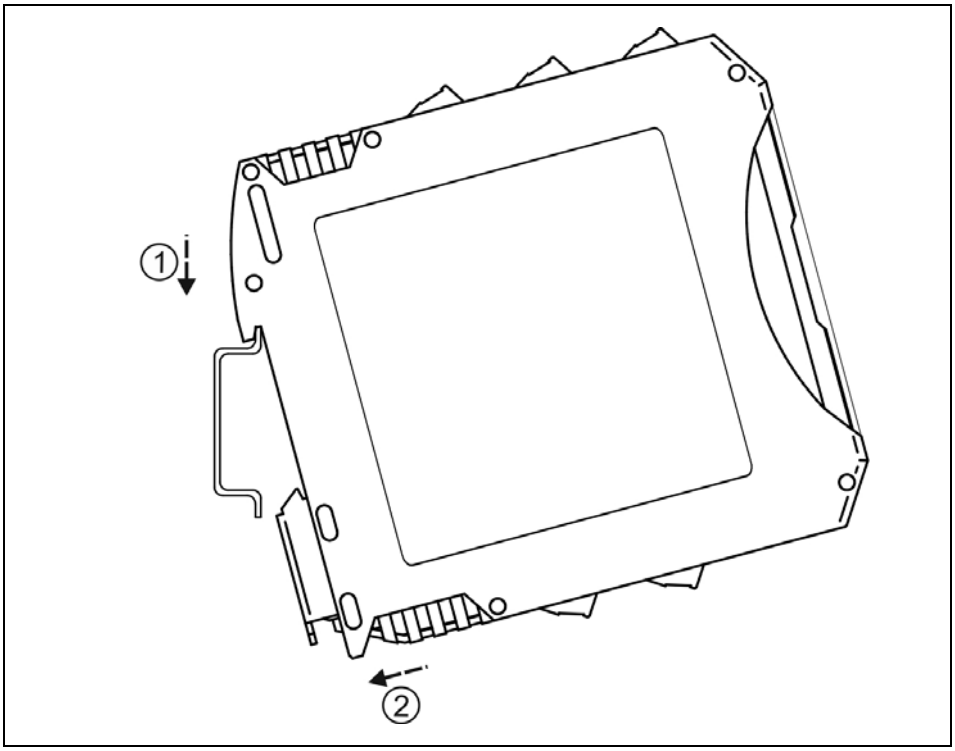
4.2. Main dimension of the instrument



4.3. Mounting procedure

The following figure shows the mounting procedures (fixing on the rail):

Mounting on the rail



The mounting doesn't need any tools.

1. Tilt the instrument according to the figure; put the instrument's mounting hole onto the upper edge of the rail (figure step 1.).
2. Push the instrument's bottom onto the bottom edge of the rail (figure step 2.), you will hear the fixing assembly closing.
3. Check the hold of the fixing by moving the instrument firmly.

5. Connecting

5.1. Preparing the connection

Always observe the following safety instructions:

- Connect or disconnect only in the complete absence of line voltage!
- If overvoltages are accepted, overvoltage arresters should be installed!
- You should take note the data concerning on the overcurrent protection in installation!
- Use only a screwdriver with appropriate head!

Select connection cable

Take note to the suitability of the connecting cable (cable cross-section, insulation, shielding).
Use a conductor with the cross-section specified in the table at the connection points of the device.

Connection point	Wire cross-section
Power input	0,75–1,5 mm2
Voltage input	0,75–2,5 mm2
Analog transmitter output	0,25–0,5 mm2

You can use solid or flexibile wire. Prepare the wire for connection as follows:

- remove the wire insulation for a length of approx. 8 mm.
- use a wire end ferrule for stranded wire.

Interference protection

If the operating environment also includes electrical equipment that emits particularly high levels of electrical interference (e.g., a variable frequency drive (VFD)), it is recommended to use shielded cables for the measurement signal cables.

Ground the shield at the cabinet side. (Only at one end of the cable, to avoid ground loops)

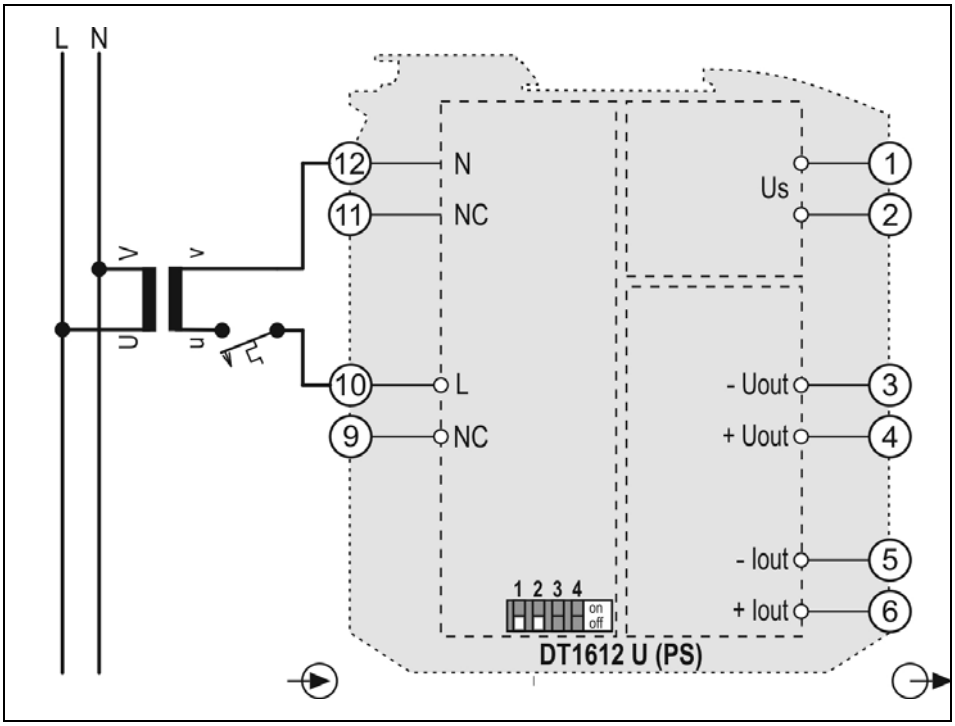
.

Another important rule is to route the measurement signal cables separately from the control and power cables.

5.2. Connecting to measuring network trough Voltage Transformer (VT) U_{IN} = 125 V

The following figure shows the wiring plan, connecting the transmitter:

Wiring plan, connecting to the power network
(see also “Application example”)

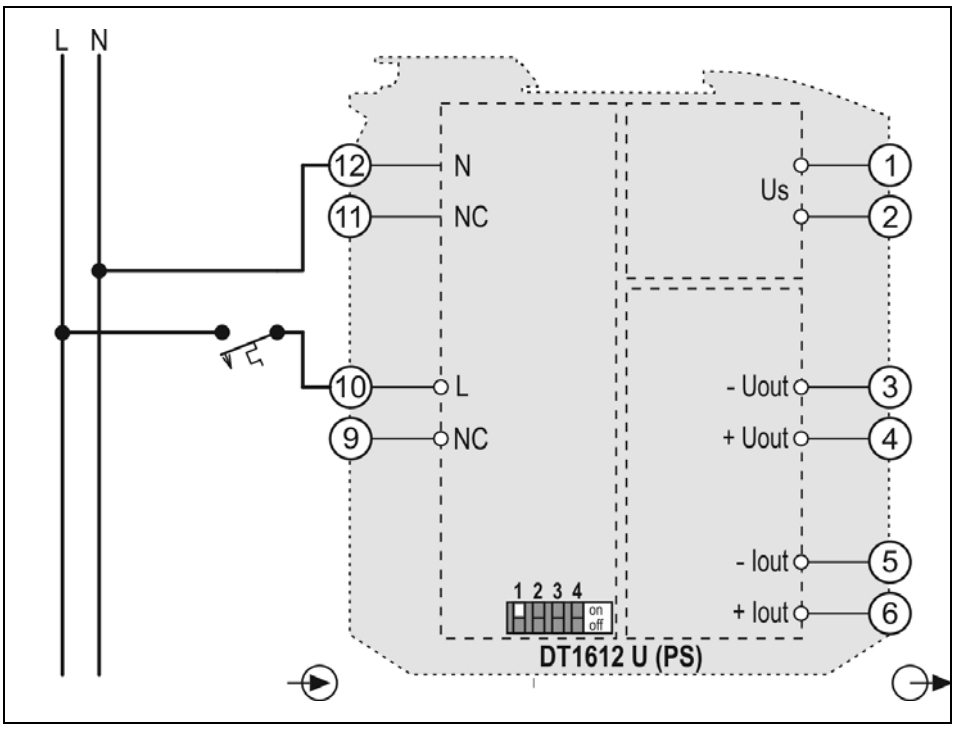


1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

5.3. Direct connecting to measuring network, U = 250 V

The following figure shows the wiring plan, connecting the transmitter:

Wiring plan, connecting to the power network
(see also “Application example”)

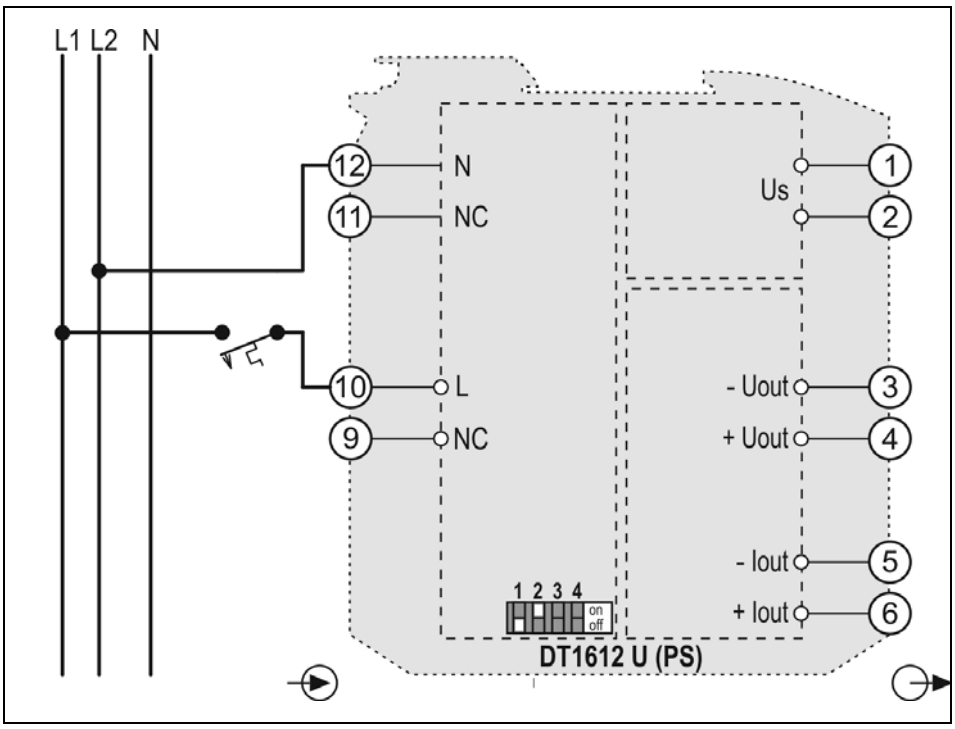


1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

5.4. Direct connecting to measuring network, U = 450 V

The following figure shows the wiring plan, connecting the transmitter:

Wiring plan, connecting to the power network
(see also “Application example”)

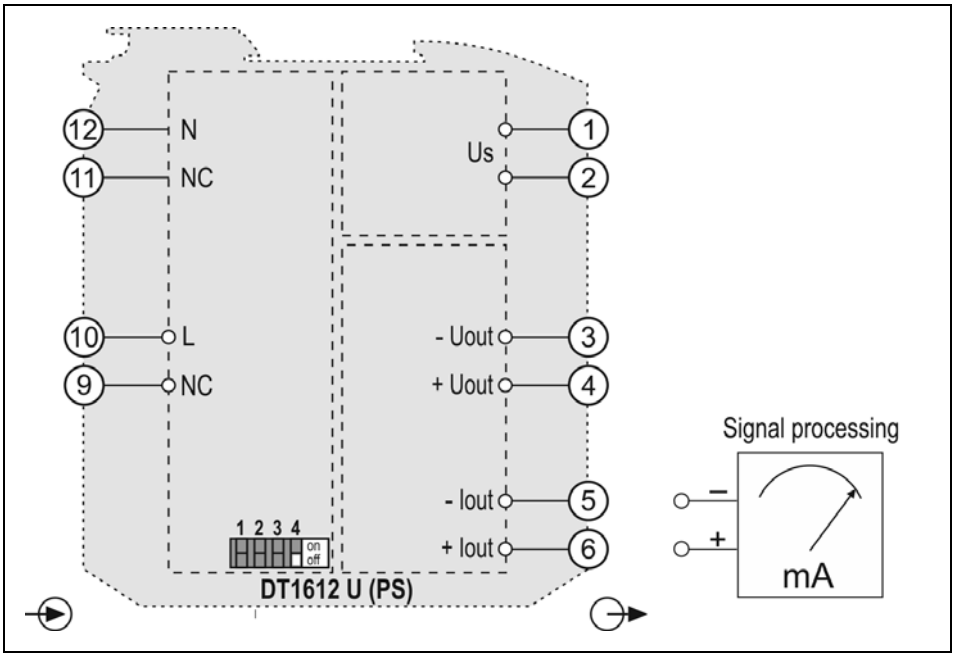


1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

5.5. Connecting to the signal proccesing unit to current trnsmitter output

The following figure shows the wiring plan, connecting the transmitter:

Wiring plan, connecting to the signal processing unit to current transmitter output.
(see also “Application example”)



Be careful the polarity of the cables

.

1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

The (3) and (4) terminals leave free!

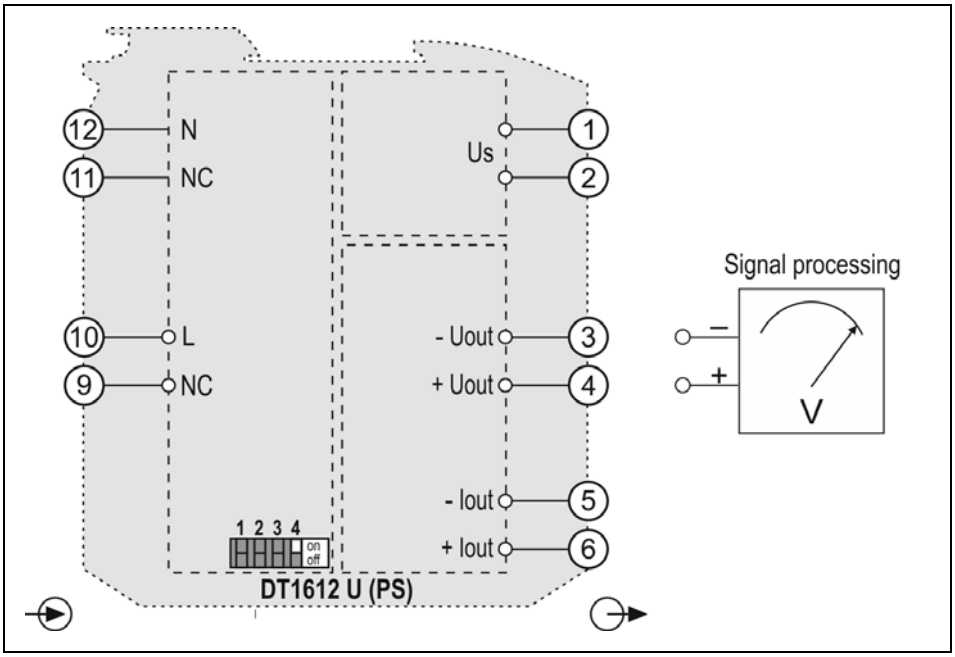
Checking the connections

Check the correctness of the connection!
(Have you connected the wires correctly, are the wire ends not shoritng each other).

5.6. Connecting to the signal proccesing unit to voltage transmitter output

The following figure shows the wiring plan, connecting the transmitter:

Wiring plan, connecting to the signal processing unit to voltage transmitter output.
(see also “Application example”)



Be careful the polarity of the cables.

1. Loosen terminal screws.
2. Insert the wire ends into the open terminals according to the wiring plan.
3. Screw the terminal in.
4. Check the hold of the wires in terminals by pulling on them firmly.

The (9) and (10) terminals leave free!

Checking the connections

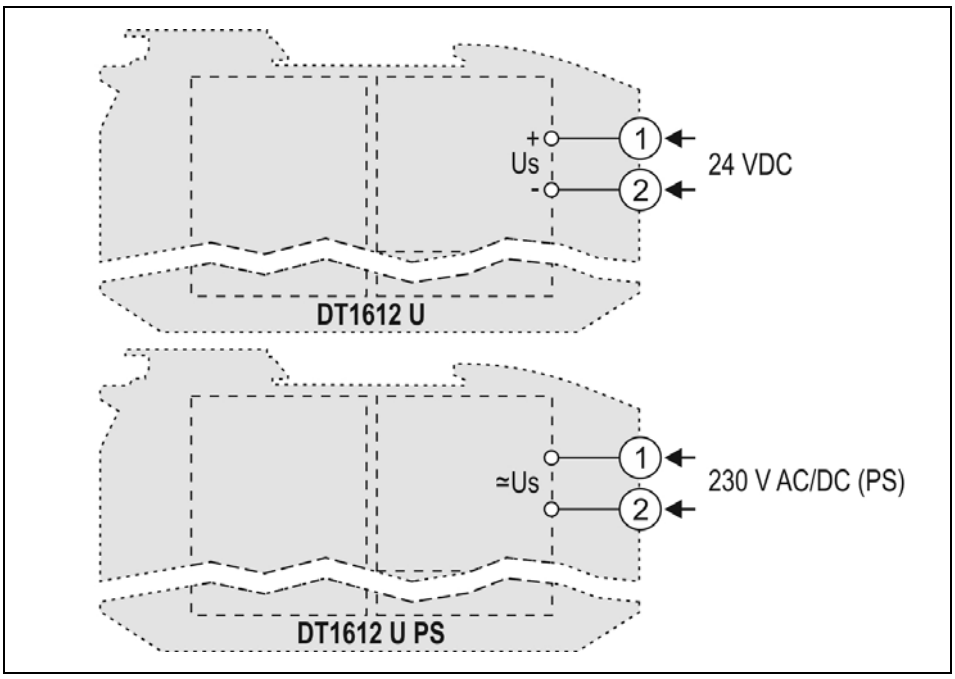
Check the correctness of the connection!
(Have you connected the wires correctly, are the wire ends not shoritng each other).

5.7. Connecting the power supply

The following figure shows the wiring plan, connecting to power network

Wiring plan, connecting to the power supply

Polarity is arbitrary



1. Check that the available supply voltage and the type designation on the device nameplate match.

The **PS** ending of the type designation and **the black color of the power connector** indicate that the device can be powered from a 230 V network.

2. Make the connection in a voltage-free state!
3. Loosen the terminal screws.
4. Insert the prepared cable ends into the open terminal blocks according to the wiring diagram.
5. Screw in the terminal screws.
6. Check the correctness of the fastenings by firmly tightening the wires.

Checking the connections

Check the correctness of the connection!
(Have you connected the wires correctly, are the wire ends not shoritng each other).

6. Frist power on, indicator LEDs

6.1. First power on

After completing the connection, apply power to the device. If connected correctly, the green “on” indicator will light up and the output can be measure a current or voltage proportional to the input signal.

Caution! If the connection points (current, voltage) are used incorrectly or if they do not match the settings, the device will not work properly!

6.2. Indicator LEDs

- **During normal operation:**
The green “on” indicator is constantly light, the red “error” indicator is dark.

- **When switching the configuration switches:**
The green “on” indicator will flash in the sequence number corresponding to the switch that was just switched.

- **In error state:**
The green “on” indicator is lit, the red “error” indicator flashes periodically. The number of consecutive flashes indicates the nature of the error:

1 flash: input overload (U = 1,4 x Un).
2 flashes : the device has failed

7. Fault rectification

7.1. Fault finding

Troubleshooting should only be carried out by a qualified and authorized technician.
The error can come from several sources: it can be a fault in the connected devices, incorrect wiring, incorrect configuration, or a fault in the DT1612 U (PS).

First check the setting. If the setting is correct, continue troubleshooting as follows:

- The green indicator is not light→ check the power supply.
If the power supply is correct, the device is faulty.
- The green indicator is light, the red indicator flashes once per second → the device input is overdriven. (U = 1,4 x Un)
- The green indicator is light, the red indicator flashes twice per second → the device is faulty.

- There is no or insufficient output signal → check the input signal and the transmitter power supply (if used).

If the input signal is correct, the device is faulty.

If the DT1612 U is faulty, contact the manufacturer's service department.

7.2. Reparing

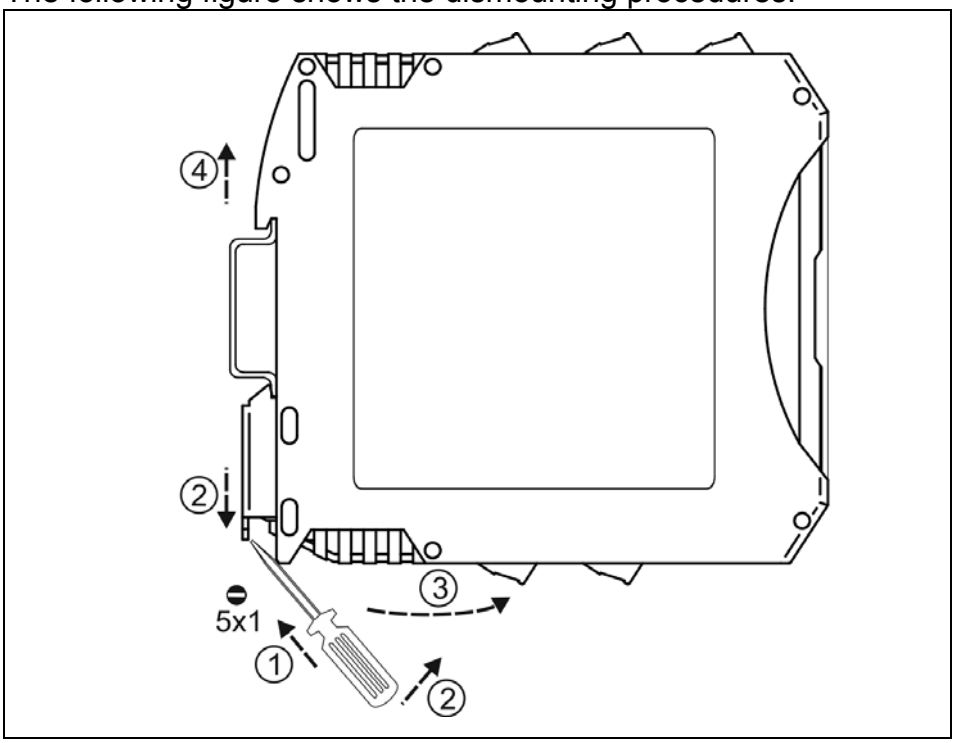
There is no user repairable part inside the instrument.
In accordance with **Point 2.1.: For safety and warranty reasons, any internal work on the instrument must be carried out only by DATCON personnel.**

8. Dismounting

8.1. Dismounting procedure

Before dismounting take note the warnings written in Chapter 5.1.
The following figure shows the dismounting procedures:

Dismounting from the rail



The dismounting procedure needs a screwdriver for slotted screws.
Before dismounting disconnect all wires.
1. Put the screwdriver end into the fixing assembly's hole (figure step 1.).
2. Lift the screwdriver handle until it possible to open the fixing assembly (figure step 2.).
3. Keeping the screwdriver in this position lift the instrument bottom from the bottom edge of the rail (figure step 3.).
Lift the whole instrument (you may put out the screwdriver) (figure step 4), the instrument will be free.

8.2. Disposal

According with the concerning EU directive, the manufacturer undertakes the disposal of the instrument that are manufactured by it and intended to be destroyed. Please deliver it in contamination-free condition to the site of the Manufacturer or to a specialized recycling company.

9. Calculation for application

9.1. Calculations

Calculating the input current from the transmitter output signal.
U_X [V]: voltage to be measured

n: voltage transformer ratio.
(in case of direct connection n = 1)

U_{IN} [V]: transmitter input voltage

I_{OUT} [mA], U_{OUT} [V]: transmitter output signal

In case of I0, U10 outputs:

$U_X = n * U_{IN} * I_{OUT} / 20$ $I_X = n * U_{IN} * U_{OUT} / 10$

1 st example:

U_{IN} = 100 V I_{OUT} = 18 mA n = 10

$U_X = 10 * 100 * 18 / 20 = 900$ V

In case of I4 output:

$U_X = n * U_{IN} * (I_{OUT} – 4) / 16$

2 nd example:

I_{IN} = 100 V I_{OUT} = 12 mA n = 10

$U_X = 10 * 100 * (12-4) / 16 = 500$ V

10. Appendix

10.1. Technical specification

Safety data:

The connection terminals of the inputs, the outputs and the supply voltages are galvanic isolated from each other. The isolation is in compliance with the standard
EN 61010-1, taking into consideration the following:

Pollution level:	2
Measurement category:	CAT III
Overcurrent protection in installation:	4 A (B)

Input parameters:

Input current:	0 – 125 VAC, 0 – 250 VAC, 0 – 450 VAC, (measuring range can be selected with a switch!)
Continuous overdrive capability:	2 x U, 500 V (max. 1 sec)
Input consumption:	0,5 VA (max.)
Frequency range:	40–400 Hz

Output parameters (current)

Output signal:	Direct current
Signal ranges:	0–20 mA, 4–20 mA; (max. 24 mA)
Overcurrent protection	40 mA (limiter)
Burden:	≤ 650 Ω
Output impedance:	> 3 MΩ

Output parameters (voltage)

Output signal:	Direct voltage
Signal ranges:	0–10 V, 2–10 V (max. 12 V)
Overvoltage protection:	18 V (határoló)
Burden:	≥ 500 Ω
Output impedance:	< 0,5 Ω

Transmission characteristics

Output signal error @ 25 ºC ±2 ºC:	±0.1% of full scale
Nonlinearity, hysteresis:	0,02% (max.)
Temperature dependence:	tip.: 25 ppm / ºC; max.: 50 ppm / ºC
Supply voltage dependence:	insignificant
Sampling frequency:	Fs = 1,1 MHz
Settling time:	120 ms
Output signal error:	0,2% (max.)
Temperature dependence:	50 ppm / °C (typical)
Frequency-response:	0,2% (max., 40–400 Hz)
Supply-voltage effect:	practically zero
Loading-effect:	practically zero
Rectifying characteristic:	TRMS value
Additional error measuring non-sinusoidal signal:	0,2% (max., F_{cres}< 3)

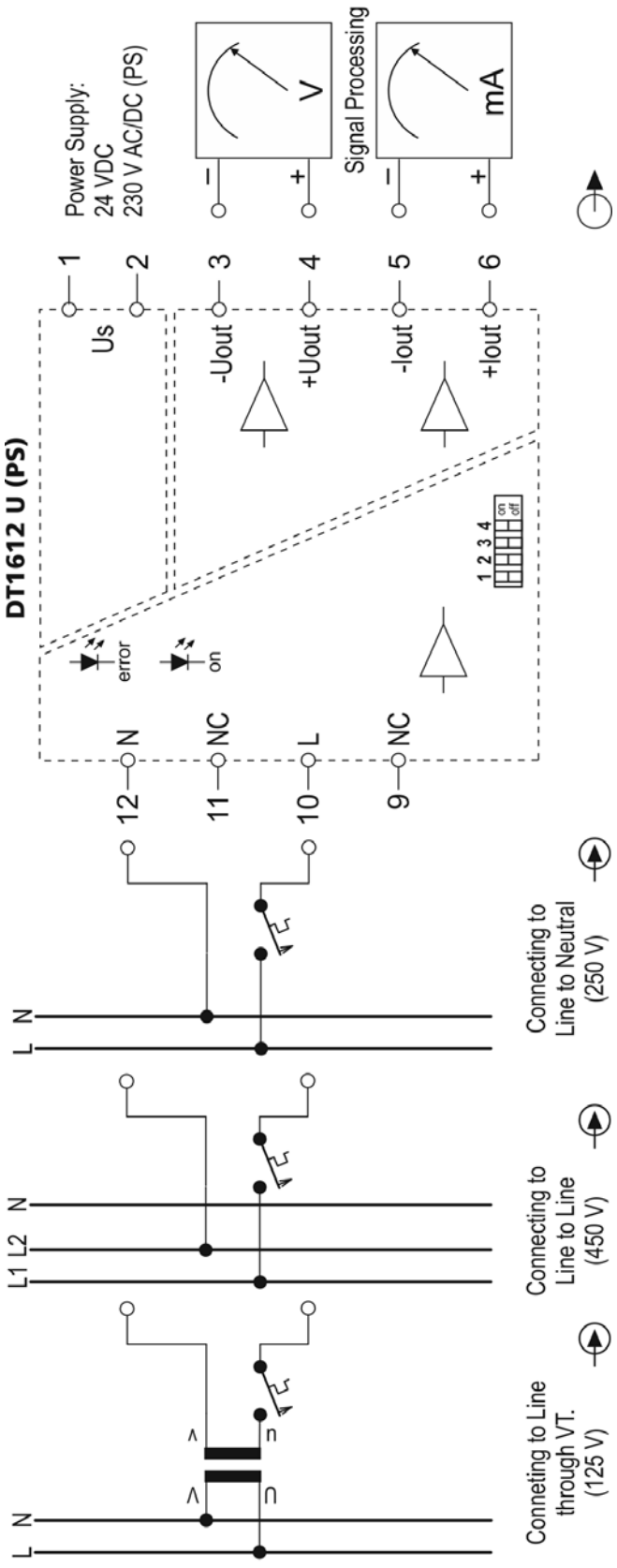
Galvanic isolation		
Operating isolating (working) voltage:	450 Vrms (between input and output and input and power terminals) 250 Vrms (between output and power terminals)	
Type test / routin test voltage:	4200 VDC (1 perc) / 2500 VDC (1 secundum)	
Capacity:	20 pF (between input, output and power supply terminals)	
Protection Class	II. (reinforced insulation)	
Leakage current:	0,005 mA (between input, output and power supply terminals)	
Power supply:		
Supply Voltage:		
DT1612 U	24 VDC ±10%, 1 W	
DT1612 U PS	230 V AC/DC ±10%, 1,5 VA (1 W)	
Overvoltage category:	CAT II.	
Installation overcurrent protection:	4 A (B)	
Ambient conditions:		
Operating temperature range:	0–50 °C (-20 – +50 °C rendelésre)	
Storage temperature range:	-20 – +70 °C	
Relative humidity:	90% (max. non condensing)	
Place of installation:	cabinet	
Mounting position:	in vertical position (on horizontal rail)	
Electromagnetic compatibility (EMC):		
Immunity: Accordance with the standard	EN 61326-1 (industrial environment)	
Electrostatic discharge (ESD):	4 kV/8 kV contact / air	-A- criterion
Transient (BURST):		
From measuring inputs:	2 kV (5/50 ns, 5KHz)	-A- criterion
From power supply input (PS):	2 kV (5/50 ns, 5KHz)	-A- criterion
From analog transmitter outputs:	1 kV (5/50 ns, 5KHz)	-A- criterion
Surge voltage (SURGE):		
From measurement inputs:	6,5 kV (CATIII, 450V)	-B- criterion
From power supply input (PS):	2 kV (line to ground)	-B- criterion
From analog transmitter outputs:	1 kV (line to ground)	-B- criterion
Conducted RF immunity: EN 55011	3 Veff	-A- criterion
Radiated RF immunity: EN 55011	E =10 V/m	-A- criterion
Interference emission: according to EN 61326-1 standard (industrial environment)		
Conducted RF emission: EN 55011	Group 1, Class A	
Radiated RF emission: EN 55011	Group 1, Class A	
Power supply voltage dip (DT1612 U PS)	20 ms @ 230 V AC/DC ±10% (0%, 1 cycle) Class 2	-A- criterion

General data:

Housing:	TS-35 rail mounting housing material: polyamide PA6.6
Connection:	screw-terminal
Connecting cable:	2,5 mm2 (max.)
Dimensions:	12,5 x 104 x 114 mm (width x height x depth)
Weight:	0,105 kg
Protection:	IP 20

The Manufacturer maintains the right to change technical data!

10.2. Application example



1148 Budapest, Fogarasi út 5. 27. ép.

Tel.: 460-1000 Fax: 460-1001 www.datcon.hu

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