

DL5

Electronic data logger



- Up to 30 input/output signals
- Up to 100 displayed channels
- 2 GB internal data memory, advanced data logging
- 5" touchscreen colour LCD
- Ethernet port, Modbus TCP Client/Server
- RS-485 port, Modbus RTU Master/Slave
- Email message on alarms status and totalisers
- Dedicated PC software for commissioning and archive data visualization
- Available languages: EN, DE, ES, FR, IT, PL, PT

DL5 is a modular data recorder, developed for wide range of applications and process measurements. Its modular construction and available up to thirty different I/O inputs, allows to configure customized measurement system.

The device is intended to measure process signals in industrial applications and may be used to measure physical values processed into a standard signals, e.g. temperature, humidity, pressure, flow, level and chemical parameters, etc. The device is perfectly suited for slow rate variable runs with changes at a few seconds intervals.

Device can communicate with master system through Ethernet port (Modbus TCP protocol, web server) or through RS-485 port (Modbus RTU protocol) and can work in distributed control systems.

Simple configuration does not requires extra programming skills. Device may be quickly configured by the user from front panel or using commissioning software on PC.

BASIC FUNCTIONS

- Measurement of process values
- Measurement of flow - two totalizers for each channel
- Two alarms or control thresholds for each channel
- Tracking the minimum and maximum values
- Math functions
- User characteristics - for linearizing non-standard transducers or sensors
- Results displaying as graph charts and tables
- Data and events logging
- Communication with a computer system
- E-mails regarding alarm states and cyclical reports with totalizers values (up to 5 recipients)

RECORDING MEASUREMENT RESULTS

- Data recording rate for process values from 2 s up to 24 h; two recording rates, toggled by alarm state
- Data recording rate for totalizers from 1 min up to 24 h
- Recording data to internal memory, access to recorded data through USB port on the front panel or through Ethernet port
- Checksum secured files - protection against data manipulation

AVAILABLE OPTIONS AND ORDERING INFORMATION

Each DL5 device is composed of the basic M module, which is made up of: USB port type A, Ethernet port, RS-485 communication interface connector; power supply from 24 VDC. Depending on the client needs, up to five different input/output modules can be installed in the device.

Module code	Module type	Description
11	IN6I(24V)	six analog inputs with standard current loop output 0-20mA or 4-20mA powered from internal 24 VDC
12	IN6I	six analog inputs with standard current loop output 0-20mA or 4-20mA (or passive transmitters with external power supply)
23	IN6T	six analog inputs for connection temperature RTD sensors type Pt100, Pt200, Pt500, Pt1000, Ni100, Ni120, Ni1000, Cu50, Cu53, Cu100, KTY81, KTY83, KTY84 and connection thermocouples TC type J, L, K, U, E, N, B, R and S; and linear measurement of resistance 0.. 4500 Ω or voltage -140 .. +140 mV
41	IN6V	six analog inputs for connecting as standard -10 .. + 10 V, 0..10 V, 2 .. 10 V, 0 .. 5 V, 1 .. 5 V
53	IN6	six analog inputs, inputs 1-3 enable connection of RTD temperature sensors, TC thermocouples and linear measurement of resistance 0 .. 4500 Ω or -140 .. +140 mV, inputs 4-6 enable the connection of transducers in the 0 / 4-20mA standard, 0 / 2-10V, 0 / 1-5V
55	IN4SG	four analog inputs +/-30 mV for direct connection of strain gauges with a sensitivity of 1, 2, 4 mV / V or other, four discrete inputs for resetting (tare) analog inputs, power supply for strain gauges 5 VDC
61	IN6D	six PULS inputs; ability to work in a state mode, frequency measurement mode (0.1 .. 1000 Hz), pulse counting (0 .. 100 Hz)
62	IN3D	three binary inputs for status tracking, frequency measurement (0.1 .. 12 500 Hz), pulse counting (0 .. 100 Hz) with the possibility of powering transducers
71	2RS485(24V)	two independent and galvanically separated RS-485 ports for reading transducers or other devices operating in the Modbus RTU standard; extra 24VDC voltage source power supply for external transducers
72	2RS485	two independent and galvanically separated RS-485 ports for reading transducers or other devices operating in the Modbus RTU standard
75	1HRT	one HART (4-20 mA) port with the possibility of powering transmitters, operating in the Primary Master mode or in the Secondary Master mode
81	OUT6RL	six solid state relays output rated at 24 VAC / 0.5 A or 36 VDC / 0.5 A
91	OUT3	three programmable analogue outputs 0/4-20mA, 0/1-5V, 0/2-10V
95	PSBATT	supplying the device with NiMH storage batteries in the event of voltage break (backup) or periodic operation with battery power supply (from 1 to 20 hours depending on the configuration)

Housing version

DL5
Panel-mount version

Front panel

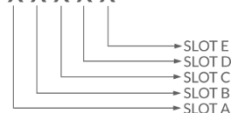


Side view



Factory configuration code

DL5-X-X-X-X-X



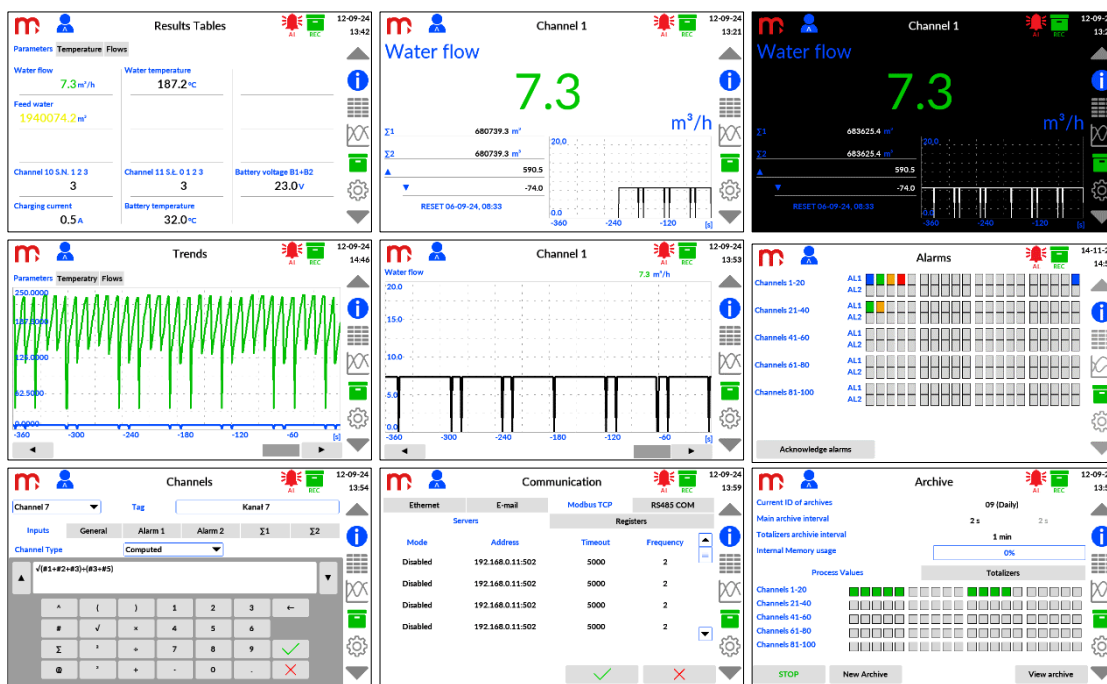
In the place of letter X, in a factory configuration code, a suitable module number should be provided as per the instruction described in the table above.

For example, device in panel-mount version, with 6 TC temperature inputs and 6 relay outputs has code:

DL5-31-81-0-0-0

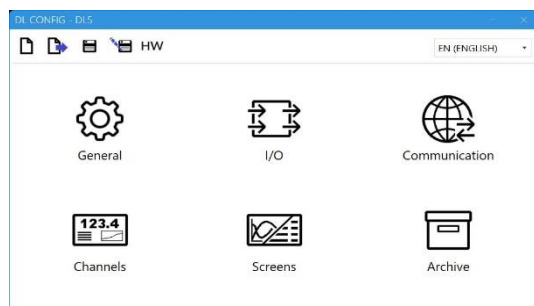
Numbers 0 in this code means, that in the device are only two modules (on SLOT A and SLOT B).

EXAMPLE DATA PRESENTATION

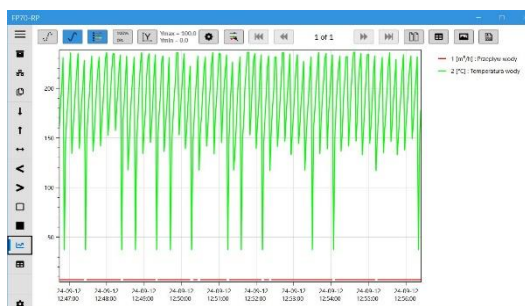


DEDICATED PC SOFTWARE

There is dedicated PC software for commissioning (DL Config) and archive data visualization (MRport).



DL Config



MRport

APPLICATION EXAMPLE



TECHNICAL SPECIFICATIONS

Front panel

Type of display	LCD TFT 5" 800 px x 480 px LED backlight
Display size	110 mm X 65 mm
Keyboard	resistive touch panel
Additional indication	LED red/blue

Port USB - front panel

Version	USB 2.0 (with limited functionality, for connection of FLASH storage)
Connector type	USB standard 'A' type socket
Protection class	IP54 (with silicone dust cover)

Port USB - rear panel

Version	USB 2.0 (with limited functionality, for connection of FLASH storage)
Port socket	USB standard 'A' type socket

Ethernet Port - rear panel

Interface	10/100 Base-T Ethernet
Connector type	RJ-45
Transmission protocol	Server WWW, Modbus TCP Client/Server ICMP (ping)

Modbus TCP Client

Number of connections opened simultaneously	Max 20
Number of read values	Max 100

Modbus TCP Server

Number of connections opened simultaneously	Max 4
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RS-485 Serial Port - rear panel

Signals output on terminal block	A(+), B(-), G, G (G - signal ground)
Maximum load	32 receivers/transmitters
Transmission protocol	Modbus RTU Slave
Transmission rate	2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps
Parity control	Even, Odd, None

Frame	1 start bit, 8 data bits, 1 stop bit
Maximum length of line	1200 m
Internal terminating resistor	V _{CC} -A(+)-B(-)-G: 390 Ω - 220 Ω - 390 Ω (activated by DIP-switches)
Maximum differential voltage A(+), B(-)	-7 V .. +12 V
Minimum output signal of transmitter	1.5 V (at R _L = 54 Ω)
Minimum sensitivity of receiver	200 mV / R _{IN} = 12 kΩ
Minimum impedance of data transmission line	54 Ω
Short-circuit / thermal protection	Yes / Yes

Internal data memory

Memory type	Flash
Capacity	2 GB
Estimated recording time for recording speed every 5 s for 16 measuring channels	ca. 2 years

Supply

Supply voltage	24 VDC (20 .. 30 VDC)
Maximum power consumption	48 W (when installed seven modules)
Security	The internal delay fuse 3.15 A, the exchange only by the service company

Electrical connections (terminal connectors)

Type	screw terminal connectors
Wire cross section	solid and flexible: 0.14 .. 1.5 mm ² flexible with bootlace ferrule 0.25 .. 1.5 mm ² AWG 30/14

Mechanical Dimensions – Housing (DL5)

Type of housing	For mounting in panels, non-flammable Lexan Resin 920
Dimensions with connectors (h X w X d)	144 mm X 144 mm X 95 mm
Dimensions of panel cut-out (h X w)	135 ⁽⁺¹⁾ mm X 135 ^(+1,1) mm
Maximum panel thickness	5 mm
Weight	ca. 0.7 kg – base set ca. 1.3 kg – full option
Protection class	IP54 on front panel side IP20 on rear panel side

Environmental conditions

Ambient temperature	0 °C .. +50 °C or 0 °C .. +40 °C depends on the device hardware configuration ⁽¹⁾
Relative humidity	5 .. 95% (without steam condensation)
Height	< 2000 m n.p.m.
Storage temperature	-30 °C .. +70 °C
Degree of pollution	PD2
EMC	EMC Directive 2014/30/UE EN 61326-1:2013 Table 2 (immunity) EN 61326-1:2013 Class A (emission)
RoHS	RoHS Directive 2011/65/EU

⁽¹⁾If module IN6I(24V) or 2RS485(24V) installed and operating as a power supply source for external devices, ambient temperature is limited to 0 °C .. +40 °C. In all other configurations the ambient temperature range is 0 °C .. +50 °C.

I/O MODULES

IN6I(24V); IN6I - 0/4-20mA INPUT TYPE MODULE⁽²⁾

Number of inputs	6
Measuring range	0–20 mA; 4–20 mA; (the actual range -22 .. 22 mA)
Resolution	0.001 mA
Measurement accuracy (T _a = +25 °C)	< ±0.1% measuring range (typically < ±0.05%)
Temperature drift	< ±0.02% /°C measuring range
Input resistance	12 Ω ±10%
Maximum input voltage	± 40 VDC
Input protection	Polymer fuse 50 mA
Transducers powered from device:	
• IN6I(24V) module	24 VDC ±15% / max 22 mA
• IN6I module	None
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	None

⁽²⁾In the device, it is possible to instal max 4 modules with power output 24V DC at the same time - IN6I(24V).

IN6T - SIX-CHANNEL TEMPERATURE INPUT MODULE

Number of inputs	6
Sensor type	<ul style="list-style-type: none"> • Resistance (Table below); 0 .. 4500 Ω • Thermocouple (Table below); ±140 mV
Measuring range	-140 .. +140 mV
Resolution	0.01 mV
Cold junction compensation	<ul style="list-style-type: none"> • Any other temperature measuring channel (in °C/°F) or a constant value • Internal sensor measurement: accuracy ±2.5 °C (value can be calibrated by the user) • For thermocouple B - no compensation
Maximum input voltage	± 40 VDC
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	None

Specifications for input type RTD

Sensor connection type	2-wire; 3-wire; 4-wire
Sensor current	200 μA
Measuring range	0 .. 4500 Ω
Resolution	0.05 Ω
Wire resistance compensation in the 3-wire connection	Automatic
Wire resistance correction in the 2-wire, 3-wire, 4-wire connection	Constant within the range of -99.99 .. +99.99 Ω
Maximum resistance of the sensor wires	20 Ω

Specifications for input type TC

Measuring range	-140 .. +140 mV
Resolution	0.01 mV
Cold junction compensation	<ul style="list-style-type: none"> • Any other temperature measuring channel (in °C/°F) or a constant value • Internal sensor measurement: accuracy ±2.5 °C (value can be calibrated by the user) • For thermocouple B - no compensation

IN6V – VOLTAGE TYPE INPUT MODULE

Number of inputs	6
Sensor type	<ul style="list-style-type: none"> • 0-10 V (2-10 V, 0-5 V, 1-5 V) • Linear voltage source
Measuring range	-10 .. +10 VDC (or sub-range) (the actual range -11 .. +11 VDC)
Resolution	0.0001 V
Measuring range (T _a = +25 °C)	< ±0.1% measuring range (typically < ±0.05%)
Temperature drift	< ±0.02% /°C measuring range
Input resistance	>100 kΩ
Maximum input voltage	± 40 VDC
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	None

IN6 – SIX-CHANNEL UNIVERSAL MODULE OF ANALOG INPUTS

Number of inputs	6	1-3 inputs RTD, TC 4-6 inputs 4-20mA, 0-10VDC
Sensor type	<ul style="list-style-type: none"> • Resistance (Table below); 0 .. 4500 Ω • Thermocouple (Table below); ±140 mV • 0–20mA; 4–20mA (with loop supply module) • ±10V / 0-10V (2-10V, 0-5V, 1-5V) 	
Maximum input voltage	± 30 VDC	
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute	
Galvanic separation between channels	None	

Specifications for input type RTD

Sensor connection type	2-wire; 3-wire; 4-wire
Sensor current	200 μA
Measuring range	0 .. 4500 Ω
Resolution	0.05 Ω
Wire resistance compensation in the 3-wire connection	Automatic
Wire resistance correction in the 2-wire, 3-wire, 4-wire connection	Constant within the range of -99.99 .. +99.99
Maximum resistance of the sensor wires	20 Ω

Specifications for input type TC

Measuring range	-140 .. +140 mV
Resolution	0.01 mV
Cold junction compensation	<ul style="list-style-type: none"> • Any other temperature measuring channel (in °C/°F) or a constant value • Internal sensor measurement: accuracy ±2.5 °C (value can be calibrated by the user) • For thermocouple B – no compensation

Specifications for input type 0-20mA, 4-20mA

Measuring range	0–20 mA; 4–20 mA; (acceptable range -22 .. 22 mA)
Resolution	0.001 mA
Measurement accuracy (T _a = +25 °C)	< ±0.1% measuring range (typically < ±0.05%)
Temperature drift	< ±0.02% /°C measuring range
Input resistance	12 Ω ±10%
Input protection	Polymer fuse 50 mA

Specifications for input type $\pm 10V / 0-10V$

Measuring range	-10 .. +10 VDC (or sub-range) (acceptable range -11 .. +11 VDC)
Resolution	0.0001 V
Measuring range ($T_a = +25\text{ }^\circ\text{C}$)	< $\pm 0.1\%$ measuring range (typically < $\pm 0.05\%$)
Temperature drift	< $\pm 0.02\%$ / $^\circ\text{C}$ measuring range
Input resistance	>100 k Ω

IN4SG - FOUR-CHANNEL STRAIN GAUGE INPUT MODULE

Number of analog inputs	4
Number of binary inputs (tare)	4
Sensore type	Strain gauge sensor, strain gauge (quarter-, half-, full-bridge configuration available)
Measuring range	-30 .. +30 mV
Resolution	0,0001 mV
Accuracy	< $\pm 0,1\%$ of 10 mV range (typically < $\pm 0,05\%$)
Temperature drift	< $\pm 0,01\%$ / $^\circ\text{C}$ of 10 mV range
Strain gauge bridge supply voltage	5 VDC
Minimum bridge resistance (4 inputs used)	250 Ω
Minimum bridge resistance (2 inputs used)	125 Ω
Minimum bridge resistance (1 inputs used)	62 Ω
Maximum input voltage	± 40 VDC
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between analog channels	None
Binary inputs (tare)	Voltage type activation; 24 VDC/5 mA (range 10-36 VDC)
Switching level	ca. 6 VDC
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between binary channels	Yes (functional separation)

IN6D - BINARY INPUTS MODULE

Number of inputs	6
Sensor type	<ul style="list-style-type: none"> • State tracking • Frequency measurement 0.1 .. 1000 Hz • Counting pulses (freq. range 0.. 100 Hz)
Resolution measurement of frequency	0.1 Hz
Measuring range (measurement of frequency)	< $\pm 0.01\%$ measuring range (typically < $\pm 0.005\%$)
Temperature drift (measurement of frequency)	< $\pm 0.002\%$ / $^\circ\text{C}$ measuring range
Input resistance	1.2 k Ω $\pm 10\%$
Input voltage operation (switching level)	0 .. 4 VDC / 5.5 .. 34 VDC (3.6 mA) ⁽³⁾ (according to PN-EN61131-2 characteristic)
Maximum input voltage	-0.3 VDC / +36 VDC
Contacts debounce filtering	off / 1 ms / 3 ms
Power supply source for external transducers	24 VDC $\pm 15\%$ / max 50 mA Protected by thermal fuse
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	None

⁽³⁾If required, other switching current level at 0.45mA, 1.55mA or 2.44mA can be selected with jumpers located on the module PCB.

IN3D - BINARY INPUTS MODULE

Number of inputs	3
Functions	<ul style="list-style-type: none"> • State tracking • Frequency measurement 0.1 .. 12500 Hz • Counting pulses (freq. range 0.. 100 Hz)
Resolution measurement of frequency	0,1 Hz
Measuring range (measurement of frequency)	< ±0.01% measuring range (typically < ±0.005%)
Temperature drift (measurement of frequency)	< ±0.002% /°C measuring range
Input resistance	1.2 kΩ ±10%
Input voltage operation (switching level)	0 .. 4 VDC / 5.5 .. 34 VDC (3.6 mA) ⁽²⁾ (according to PN-EN61131-2 characteristic)
Maximum input voltage	-0.3 VDC / +36 VDC
Contacts debounce filtering	off / 3 ms
Power supply source for external transducers	24 VDC ±15% / max 50 mA Protected by thermal fuse
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Configuration: OC/contact⁽¹⁾	
Open circuit voltage	12 V
Short circuit current	12 mA
On/off threshold	2.7 V / 2.4 V
⁽¹⁾ The default setting.	
Configuration: voltage input	
Input resistance	>10 kΩ
On/off threshold	2.7 V / 2.4 V
Open circuit voltage	12 V
Configuration: Namur	
High impedance state	0.4 .. 1 mA
Low impedance state	2.2 .. 6.5 mA
2RS485(24V); 2RS485 - RS485 PORTS INPUT MODULE (MODBUS RTU MASTER)⁽⁴⁾	
Number of ports	2
Maximum number of process values read	25 (one or both ports in total)
Signals output on terminal block	A(+), B(-), 2x G (G - signal ground)
Maximum bus load	32 receivers / transmitters
Transmission protocol	Modbus RTU Master
Transmission rate	1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 kbps
Parity control	Even, Odd, None
Frame	1 start bit, 8 data bits, 1 stop bit
Galvanic separation	250 VAC; 1500 VAC for 1 minute
Maximum length of line	1200 m
Internal terminating resistor	V _{CC} -A(+)-B(-)-G: 390 Ω - 220 Ω - 390 Ω (activated by DIP-switches)
Maximum differential voltage A(+), B(-)	-9 V .. +14 V
Minimum output signal of transmitter	1.5 V (at R _L = 54 Ω)
Minimum sensitivity of receiver	200 mV / R _{IN} = 12 kΩ
Minimum impedance of data transmission line	54 Ω
Short-circuit / thermal protection	Yes / Yes
Additional power supply 24 VDC source	
• 2RS485(24V) module	3 four pole terminal block (+ + - -) 24 VDC ±15% / max 200 mA

• 2RS485 module	None
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⁽⁴⁾In the device, it is possible to instal max 4 modules with power output 24V DC at the same time - 2RS485(24V).

1HRT - HART (4-20 mA) PORT INPUT MODULE

Transmission protocol	<ul style="list-style-type: none"> • rev 4, rev 5, rev 6, rev 7 • Primary Master or Secondary Master
Functions	Supported 0, 1, 3, 6, 9 commands: <ul style="list-style-type: none"> • Reading PV, SV, TV, FV and DVC variables • Reading the Long Address (rev 5, rev 6, rev 7) • Changing the Short Address • Reading the unique identifier frame (test)
Maximum number of devices	15
Maximum number of variables read	25
Multidrop operating mode	Yes, up to 15 devices (multidrop)
Loop power supply	24 VDC (max 60 mA)
Analog reading of the 4-20mA line	No
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Internal resistor	250 Ω , disabled by default ⁽⁵⁾

⁽⁵⁾The resistor can be switched on/off in the data logger I/O settings menu. The resistor is automatically disconnected in the event of a power outage.

OUT6RL - RELAY OUTPUTS MODULE

Number of outputs	6
Sensor type	Solid-state relays (SSR)
Maximum operating voltage / operating current	24 VAC / 0.5 A or 36 VDC / 0.5 A
The maximum voltage allowed	42 VAC or 60 VDC
Maximum peak current	1.5 A for 1 ms
Galvanic separation from the other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	250 VAC; 1500 VAC for 1 minute

OUT3 - ANALOGUE OUTPUTS MODULE

Number of outputs (channels)	3
Specifications for current output	
Range (program selected)	4 - 20 mA 0 - 20 mA 0 - 24 mA
Output type	Active current source
Possibility of powering the current loop from an external voltage source	None
Resolution	12 bit / 0.006 mA
Accuracy ($R_L=350 \Omega$ / $T_a = +25 \text{ }^\circ\text{C}$)	$< \pm 0.15\%$ ($< \pm 0.036 \text{ mA}$) full range of measurement (FSR)
Accuracy ($R_L=350 \Omega$ / $T_a = -40 \text{ }^\circ\text{C} .. +50 \text{ }^\circ\text{C}$)	$< \pm 0.3\%$ ($< \pm 0.072 \text{ mA}$) full range of measurement (FSR)
Load resistance R_L	0 Ω .. 500 Ω
Maximum output voltage (for $R_L = \infty \Omega$)	21.5 V
Specifications for voltage output	
Range (program selected)	0 - 5 VDC 0 - 10 VDC
Output type	DC voltage source
Resolution	12 bit (1.25 mV for 0 - 5 V)

	(2.5 mV for 0 - 10 V)
Accuracy ($R_L=1\text{ k}\Omega/C_L=200\text{ pF}/T_a=+25\text{ }^\circ\text{C}$)	< $\pm 0.1\%$ full range of measurement (FSR) (Typically < $\pm 0.05\%$ FSR)
Accuracy ($R_L=1\text{ k}\Omega/C_L=200\text{ pF}/T_a=-40\text{ }^\circ\text{C}..+50\text{ }^\circ\text{C}$)	< $\pm 0.3\%$ full range of measurement (FSR)
The minimum load resistance R_L	1 k Ω
The maximum load capacitance C_L	1 μF
Short-circuit protection	Yes

Specifications for current and voltage output

Galvanic separation from other circuits	250 VAC; 1500 VAC for 1 minute
Galvanic separation between channels	250 VAC; 1500 VAC for 1 minute

PSBATT – MODULE FOR OPERATION WITH A BACK-UP BATTERY⁽⁶⁾

Input voltage 24 VDC IN	24 VDC / 2 .. 2.5 A
BATT1, BATT2 (capacity)	NiMH 2x9.6 V / 1000 .. 6000 mAh (Typically 4600 mAh or 2000 mAh)
BATT1, BATT2 temperature sensor	2x NTC 10 k Ω
Charging time	ca. 12 h (full charging)

⁽⁶⁾In the device, it is possible to instal only 1 PSBATT module. From April 1, 2020, the PSBATT module is manufactured only in version 1.2. Version 1.2 of the module is not backward compatible. The Datasheet contains information about the module's technical data in version 1.2. Technical details about the module in version 1.0 and in version 1.1 are available from the Manufacturer. Use only dedicated power supply.

TABLE OF RTD SENSORS

Sensor type	Range	Accuracy
Pt100, Pt200, Pt500, Pt1000 (EN 60751+A2:1995)	-200 $^\circ\text{C}..+850\text{ }^\circ\text{C}$ -328 $^\circ\text{F}..+1562\text{ }^\circ\text{F}$	$\pm 0.5\text{ }^\circ\text{C}$ (typically $\pm 0.3\text{ }^\circ\text{C}$) $\pm 0.9\text{ }^\circ\text{F}$ (typically $\pm 0.5\text{ }^\circ\text{F}$)
Ni100, Ni120, Ni1000 (DIN43760 /08-1985)	-60 $^\circ\text{C}..+250\text{ }^\circ\text{C}$ -76 $^\circ\text{F}..+482\text{ }^\circ\text{F}$	$\pm 0.5\text{ }^\circ\text{C}$ (typically $\pm 0.3\text{ }^\circ\text{C}$) $\pm 0.9\text{ }^\circ\text{F}$ (typically $\pm 0.5\text{ }^\circ\text{F}$)
Cu50, Cu53, Cu100 (GOST6651-2009)	-180 $^\circ\text{C}..+200\text{ }^\circ\text{C}$ -292 $^\circ\text{F}..+392\text{ }^\circ\text{F}$	$\pm 0.5\text{ }^\circ\text{C}$ (typically $\pm 0.3\text{ }^\circ\text{C}$) $\pm 0.9\text{ }^\circ\text{F}$ (typically $\pm 0.5\text{ }^\circ\text{F}$)
KTY81 (NXP Rev05-25.04.2008)	-55 $^\circ\text{C}..+150\text{ }^\circ\text{C}$ -67 $^\circ\text{F}..+302\text{ }^\circ\text{F}$	$\pm 0.5\text{ }^\circ\text{C}$ $\pm 0.9\text{ }^\circ\text{F}$
KTY83 (NXP Rev06-4.04.2008)	-55 $^\circ\text{C}..+175\text{ }^\circ\text{C}$ -67 $^\circ\text{F}..+347\text{ }^\circ\text{F}$	$\pm 0.5\text{ }^\circ\text{C}$ $\pm 0.9\text{ }^\circ\text{F}$
KTY84 (NXP Rev06-8.05.2008)	-40 $^\circ\text{C}..+300\text{ }^\circ\text{C}$ -40 $^\circ\text{F}..+572\text{ }^\circ\text{F}$	$\pm 0.8\text{ }^\circ\text{C}$ $\pm 1.5\text{ }^\circ\text{F}$
Linear resistance	0 .. 4700 Ω (or sub-range)	$\pm 0.5\text{ }^\circ\Omega$ (typically $\pm 0.3\text{ }^\circ\Omega$)

TABLE OF THERMOCOUPLES (TC)

Sensor type	Range	Accuracy
J (Fe-CuNi) (EN60584-1:1995)	-210 $^\circ\text{C}..+1200\text{ }^\circ\text{C}$ (compensation range -100 $^\circ\text{C}..+300\text{ }^\circ\text{C}$) -346 $^\circ\text{F}..+2192\text{ }^\circ\text{F}$ (compensation range -148 $^\circ\text{F}..+572\text{ }^\circ\text{F}$)	$\pm 1.0\text{ }^\circ\text{C}$ (typically $\pm 0.5\text{ }^\circ\text{C}$) $\pm 1.8\text{ }^\circ\text{F}$ (typically $\pm 0.9\text{ }^\circ\text{F}$) (without compensation)
K (NiCr-NiAl) (EN60584-1:1995)	-270 $^\circ\text{C}..+1372\text{ }^\circ\text{C}$ (compensation range -100 $^\circ\text{C}..+300\text{ }^\circ\text{C}$) -454 $^\circ\text{F}..+2501.6\text{ }^\circ\text{F}$ (compensation range -148 $^\circ\text{F}..+572\text{ }^\circ\text{F}$)	$\pm 1.0\text{ }^\circ\text{C}$ (typically $\pm 0.5\text{ }^\circ\text{C}$) $\pm 1.8\text{ }^\circ\text{F}$ (typically $\pm 0.9\text{ }^\circ\text{F}$) (without compensation)
N (NiCrSi-NiSi) (EN60584-1:1995)	-270 $^\circ\text{C}..+1300\text{ }^\circ\text{C}$ (compensation range -100 $^\circ\text{C}..+300\text{ }^\circ\text{C}$)	$\pm 2.0\text{ }^\circ\text{C}$ (typically $\pm 1.0\text{ }^\circ\text{C}$)

	-454 °F .. +2372 °F (compensation range -148 °F .. +572 °F)	±3.6 °F (typically ±1.8 °F) (without compensation)
R (PtRh 13-Pt) (EN60584-1:1995)	-50 °C .. +1768 °C (compensation range -50 °C .. +300 °C) -58 °F .. +3214.4 °F (compensation range -58 °F .. +572 °F)	±2.0 °C (typically ±1.0 °C) ±3.6 °F (typically ±1.8 °F) (without compensation)
S (PtRh 10-Pt) (EN60584-1:1995)	-50 °C .. +1768 °C (compensation range -50 °C .. +300 °C) -58 °F .. +3214.4 °F (compensation range -58 °F .. +572 °F)	±2.0 °C (typically ±1.0 °C) ±3.6 °F (typically ±1.8 °F) (without compensation)
T (Cu-CuNi) (EN60584-1:1995)	-200 °C .. +400 °C (compensation range -50 °C .. +300 °C) -328 °F .. +752 °F (compensation range -58 °F .. +572 °F)	±1.0 °C (typically ±0.5 °C) ±1.8 °F (typically ±0.9 °F) (without compensation)
E (NiCr-CuNi) (EN60584-1:1995)	-270 °C .. +1000 °C (compensation range -50 °C .. +300 °C) -454 °F .. +1832 °F (compensation range -58 °F .. +572 °F)	±1.0 °C (typically ±0.5 °C) ±1.8 °F (typically ±0.9 °F) (without compensation)
B (PtRh30-PtRh6) (EN60584-1:1995)	+250 °C .. +1820 °C (without compensation) +482 °F .. +3308 °F (without compensation)	±2.0 °C (typically ±1.0 °C) ±3.6 °F (typically ±1.8 °F) (without compensation)
L (Fe-CuNi) (DIN43710)	-200 °C .. +900 °C (compensation range -50 °C .. +300 °C) -328 °F .. +1652 °F (compensation range -58 °F .. +572 °F)	±1.0 °C (typically ±0.5 °C) ±1.8 °F (typically ±0.9 °F) (without compensation)
U (Cu-CuNi) (DIN43710)	-200 °C .. +600 °C (compensation range -50 °C .. +300 °C) -328 °F .. +1112 °F (compensation range -58 °F .. +572 °F)	±1.0 °C (typically ±0.5 °C) ±1.8 °F (typically ±0.9 °F) (without compensation)
Line voltage	-140 .. +140 mV (or sub-range)	<0.2% full range

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