AnDi Plus

M-Bus A/D Converter with one 0/4-20mA or 0-10V input and one PT100 sensor input

User Manual

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1. Functional Description

The AnDi^Plus is a compact, M-Bus-enabled A/D converter designed to acquire analog and temperature measurement signals and transmit them via the M-Bus protocol. The main features and functions of the device are summarized below:

- Converts analog signals to M-Bus telegrams according to EN 13757-2/3
- The device provides M-Bus telegrams containing:
  - The measured value from either the **voltage (V)** or **current (mA)** input, based on user configuration
  - The temperature value from the **PT sensor** input (always included)
- Supports the following input types:
  - Current input: **0–20 mA** and **4–20 mA**
  - Voltage input: **0–10 V**
  - Temperature sensor: **PT100** (default), **PT1000** (optional)
- Temperature input supports both **2-wire** and **3-wire** configurations
- Sensor inputs can operate in two modes:
  - **Active mode**: AnDi^Plus provides power to the sensor (e.g., passive 4–20 mA sensors)
  - **Passive mode**: AnDi^Plus reads signals from externally powered (active) sensors
- Integrated sensor power supply:
  - DC output: approximately **24 V**, limited to **25 mA**, short-circuit protected
- User-configurable via M-Bus commands:
  - **Measurement type**: voltage or current
  - **PT input correction** (offset/gain adjustment)
  - **Primary and secondary addresses**
  - **Measurement unit and signal type** (e.g., pressure, temperature, voltage)
  - **Lower and upper range values**
- Features **galvanic isolation** between the sensor input section and M-Bus communication/power domains to ensure:
  - Electrical safety
  - Signal integrity
  - Elimination of ground loops
- Compact form factor suitable for DIN-rail or cabinet installation
- LED indicators for **Power**, **M-Bus communication**, and **Status**
- Typical applications include integration of analog sensors into building automation, energy monitoring, and industrial control systems

2. Installation

2.1 Schematic Diagram

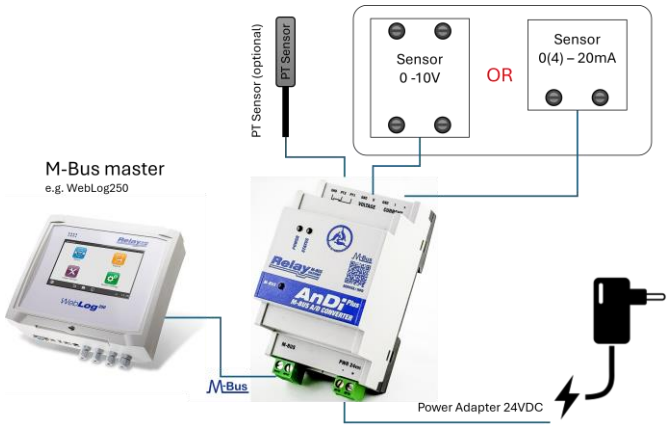


Figure 1: System Wiring Overview (Power, M-Bus, Sensor Inputs)

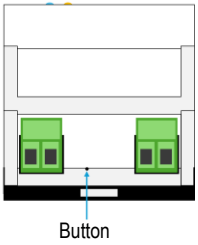
2.2 Mounting

The AnDi^Plus is housed in a compact plastic enclosure suitable for **DIN rail mounting**. The device is designed for installation on a **TS35 top-hat rail** according to **DIN EN 50022**. The enclosure width occupies **3 division units (3 DU)**, while its **low installation height of 60 mm** allows mounting not only in standard control cabinets but also in **meter cabinets behind protective covers**.

This compact form factor makes the AnDi^Plus suitable for both industrial and commercial applications where space-saving installation is required.

2.3 Connectors and LEDs

2.3.1 Overview



Remove write protection using the button:
Use wire Ø 0.5mm / needle
Press only briefly: flashes 2 x quickly, removes the write protection

Figure 2: Terminal Layout – Power, M-Bus, and Sensor Connections

The illustration shows a top view of the connectors: All terminals are pluggable, making it easier to wire and replace the AnDi^Plus in the event of a fault.

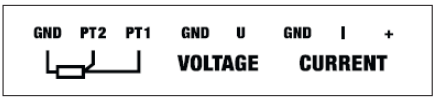
Attention: Please ensure that the terminals are correctly replaced in their intended position after removal. Incorrectly positioned terminals can lead to defects.

Terminal assignment:

Upper terminals (sensor signals)
Lower terminals (M-Bus and power)

Meaning of the LED indicators:

Labelling	Colour	Description
POWER	green	Power OK
STATUS	yellow	shows status of the AnDi^Plus
M-Bus	blue	ON: M-Bus connected flashing: communication



Type	Signal	Description
PWR (POWER)	- / +	Power supply input, voltage 10-30 VDC (attention to polarity)
M-BUS		M-Bus input (polarity independent)
GND PT2 PT1	GND, PT2, PT1	Input for PT100 sensor (2 or 3 wire)
Voltage	GND, U	Input for sensor with 0-10V signal
Current	GND, I, +	Input for sensor with 0/4-20 input (active or passive sensor)

2.3.2 Status LED

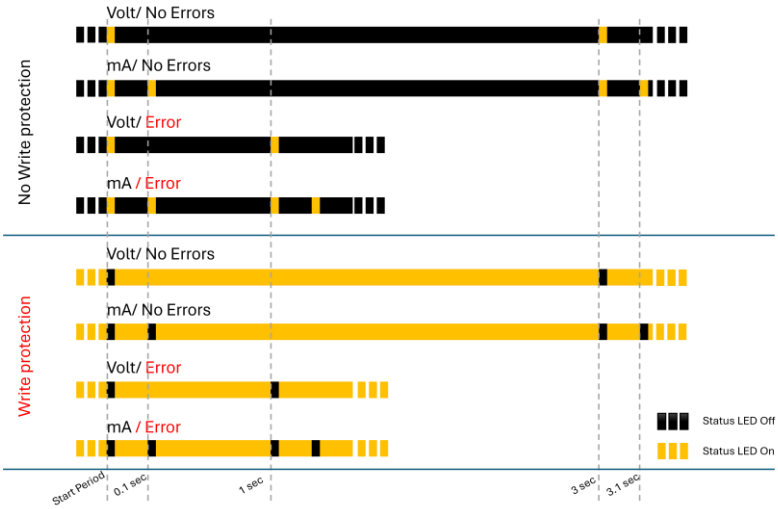


Figure 3: Status LED Indicator Functions

2.4 Electrical Connections

2.4.1 Power Supply

The AnDi^Plus requires a **regulated DC supply voltage in the range of 10 to 30 VDC**. The connection is made via a two-pin terminal block marked **PWR 24VDC**.

2.4.2 M-Bus Interface

The M-Bus connection is made via the terminal marked **M-BUS**. The connection is **polarity-independent** and compatible with standard M-Bus masters (e.g., Relay WebLog250 or third-party devices).

The AnDi^Plus operates as a standard M-Bus slave and supports communication speeds of **300 or 2400 baud with automatic baud rate detection**.

2.4.3 Sensor Inputs

The device includes the following sensor inputs:

- **Current Input (0–20 mA / 4–20 mA):** **Figure 4**
  The current signal is connected to terminals marked **+**, **I**, and **GND**. The input supports both **active sensors** (current source) and **passive sensors** (current sink powered by the AnDi^Plus, typ. 24VDC / max. 25mA)

- **Voltage Input (0–10 V):** **Figure 5**
  The voltage signal is connected to the **U** and **GND** terminals. The input impedance is suitable for direct connection to standard 0–10 V signal sources.

- **PT100 / PT1000 Temperature Sensor Input:** **Figure 6**
  Terminals **PT1**, **PT2**, and **GND** are used for connection of a platinum temperature sensor.
  - Default: **PT100**
  - Optional: **PT1000** (ordering option)
  - Supported configurations: **2-wire** (use the 2-pole bridge between PT1 and PT2, included with delivery) or **3-wire**

Note: If no PT sensor is connected, the AnDi Plus still includes a temperature field in the M-Bus telegram with default data and a function “Error” will be on the DIF (see 5.2).

Note: The sensor type (PT100 or PT1000) is **defined at the time of ordering** and configured in the firmware accordingly. It is **not auto detected** and must match the version shown on the device label (side sticker).

Please check the label on the housing to confirm whether your device is configured for PT100 or PT1000 operation.

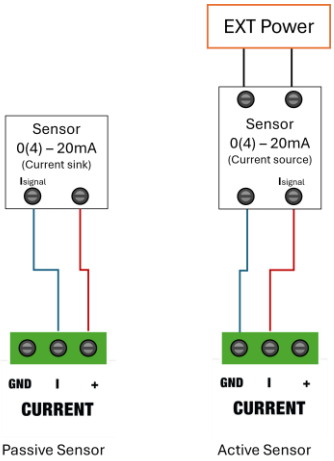


Figure 4: Current Sensor Connection (0/4–20 mA)

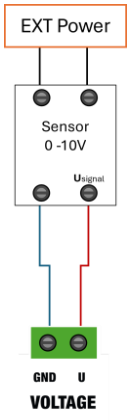


Figure 5: Voltage Sensor Connection (0–10 V)

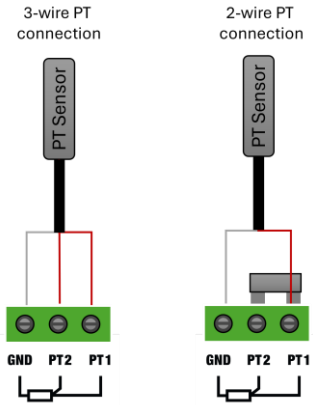


Figure 6: PT Sensor Connection (2-wire / 3-wire)

3. Galvanic Isolation Concept

The AnDi^Plus is designed with **full galvanic isolation** between all key system domains, ensuring robust and interference-free operation in industrial and building automation environments.

As illustrated in figure 7, the device is internally divided into **three electrically isolated sections**:

1. **Sensor Input Section** – handles analog voltage, current, and temperature measurements
2. **M-Bus Communication Section** – manages protocol handling and communication with M-Bus masters
3. **Power Supply Section** – provides internal and optional sensor power

These sections are completely isolated from each other, meaning:

- **Sensors are fully isolated** from both the M-Bus communication and the power supply
- The **MCU (microcontroller)** acts as the central processor with secure isolation boundaries on all interfaces
- Isolation prevents **ground loops**, **voltage surges**, and **electromagnetic interference** from propagating across domains
- This architecture protects internal components and ensures measurement accuracy and device safety

This robust separation of power, data, and measurement paths makes the AnDi^Plus especially well-suited for mixed-signal environments and installations where reliable operation and electrical safety are critical.

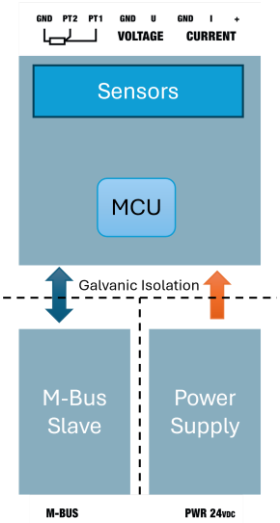


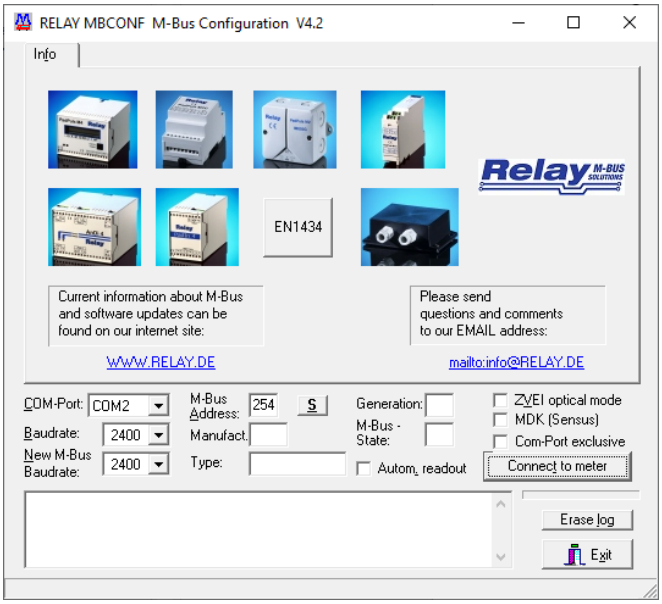
Figure 7: Galvanic Isolation Architecture

4. Parameterization Using MBCONF

The AnDi^Plus can be configured using our Windows software **MBCONF**, which allows the user to set up measurement type, address, scaling, and other parameters directly through the M-Bus connection.

4.1 Installing MBCONF

- **MBCONF** is the official configuration tool for AnDi^Plus devices. It communicates with the AnDi^Plus through the same **M-Bus slave port**.
- To use it, you will need an **M-Bus master interface**, such as:
  - **M-Bus Mikro-Master**, **PW100**, **PW50**, or any other compatible **USB/RS232 to M-Bus converter** supplying a transparent virtual comport
- You can download the latest MBCONF (V4.2 or higher is required) version from our web-site:
  - Go to **www.relay.de**
  - Navigate to **Products - Software**
  - Download the **full version of MBCONF**
- MBCONF is a **Windows application only**, so a PC with a Windows operating system is required.
- Follow the installation steps to complete the setup. No activation is needed - **the full version is available and ready to use without any unlocking**.

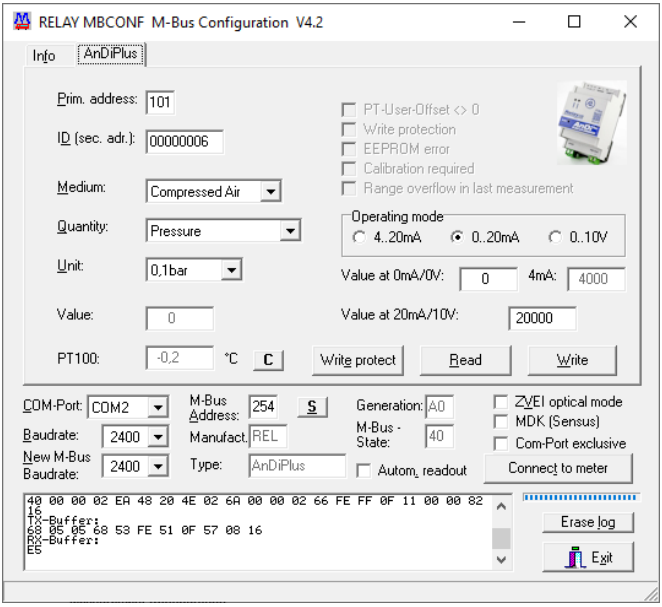


4.2 Starting and Connecting to your AnDi^Plus

1. **Power on the AnDi^Plus** and connect it to your M-Bus master interface.
2. The **M-Bus LED** on the device should light up when a valid signal is detected from the M-Bus master.
3. In MBCONF, select the correct **COM port** used by your M-Bus converter.
4. Choose the **baud rate**: either **300** or **2400** baud (AnDi^Plus supports both by default).
5. To connect to a device in factory state or for the first time, you can use one of the following methods:
   - **Method A – Broadcast mode**:
     If the AnDi^Plus is the **only device connected to the M-Bus line**, you can access it using the **broadcast address 254** without entering any ID.
   - **Method B – Secondary address (ID selection)**:
     This method is recommended when:
     - There are **multiple devices** on the M-Bus line
     - You want to connect using the device's **serial number**

     Steps:
     - Click the **"S"** button to open the **ID selection** dialog
     - Enter the **8-digit serial number** of your device (e.g., Serial number 00245 → enter **00000245**)
     - Click **Select**, then **Connect to Device**
     - Ensure that **no other communication or requests** are active on the M-Bus line during this operation
6. Once successfully connected, **MBCONF will automatically open the AnDi^Plus configuration page**, where you can adjust device settings.
7. The following **fields are automatically filled** after connecting to the device and **cannot be edited by the user**. They display information provided by the AnDi^Plus firmware:
   - **Manufact.**
     Displays the 3-letter manufacturer code (e.g., REL) after successful communication. This identifies the device origin and is read-only.
   - **Generation**
     Shows the internal software version or firmware revision of the connected AnDi^Plus device. This helps identify compatibility and update status.
   - **Type**
     Indicates the product model (e.g., "AnDi Plus") to confirm the device type being configured.
   - **M-Bus State**
     Displays the current status of the device on the M-Bus network, such as normal operation or communication errors. Used for diagnostics.

4.3 Configuring the AnDi^Plus



Once connected, MBCONF automatically opens the configuration page for your AnDi^Plus. This section allows you to view live values and set parameters for measurement, signal scaling, and address configuration.

Address and Identification

- **Primary Address**
  Sets the M-Bus primary address (1–250).
- **ID (Secondary Address)**
  Displays the 8-digit M-Bus ID used for secondary addressing.

Measurement Configuration

- **Medium**
  Selects the application type (e.g., water, oil, heat).
- **Quantity**
  Defines the measured physical property (e.g., temperature, pressure).
- **Unit**
  Sets the measurement unit according to the selected quantity.
- **Value**
  Shows the current scaled measurement from the analog input.

PT100 / PT1000 Temperature Sensor

- **PT100 (°C) or PT100 (°C)**
  Displays the measured temperature from the PT input.
- **C Button (Correction)**
  Allows the user to add or subtract a correction value (–10000 to +10000 = ±10 °C), in steps of 0.001 °C. Useful for 2-wire sensors and cable compensation.

Device Status

- **PT-User Offset ≠ 0**
  Indicates that a PT correction value has been applied (not equal to zero).
- **Write Protection**
  Checked when the device is locked against configuration changes. Must be disabled by a button at the device to allow editing.
- **EEPROM Error**
  Appears when an error occurred while reading stored parameters. Reconfiguration is required.
- **Calibration Required**
  Indicates invalid or missing calibration data. Measured values may be incorrect.
- **Range Overflow in Last Measurement**
  Set if the last input value exceeded the configured range.

Operating Mode and Scaling

- **Operating Mode**
  Selects the analog signal input type:
  - 4–20 mA
  - 0–20 mA
  - 0–10 V
- **Value at 0 mA / 0 V**
  Defines the lower limit for 0–20 mA or 0–10 V inputs.
- **Value at 4 mA**
  Defines the lower limit for 4–20 mA input.
- **Value at 20 mA / 10 V**
  Sets the upper limit for analog input scaling.

Actions

- **Read**
  Loads current settings and values from the device.
- **Write**
  Saves all current settings to the device memory.
- **Write Protection**
  Enables write protection manually. Disabling only by button on the device (see page 5).

5. M-Bus Telegrams

5.1 Configuration of AnDi^Plus with SND_UD

Position	1	2	3	4	5	6	7	8	9	10	11	12
Name:	Start	Len	Len	Start	C	A	CI	DIF1	VIF1	PAdr	DIF2	VIF2
Value (hex):	68	1C	1C	68	53		51	01	7A		07	79

13	14	15	16	17	18	19	20	21	22	23	24	25	26
ID_0	ID_1	ID_2	ID_3	Man_0	Man_1	Gen	Med	DIF3	VIF3	VIFE3	$Offs_0$	$Offs_1$	DIF4
				AC	48	3x		02		40			

27	28	29	30	31	32	33	34
VIF4	VIFE4	Max_0	Max_1	DIF5	Anw.	CS	Stop
	48			0F			16

Configuration telegram

A:	primary address
PAdr:	new primary address
ID_{0-3}:	identification no. for secondary addressing
Man_{0-1}:	manufacturer code
Gen:	revision of firmware (current: 0xa0)
Med:	medium
VIF3=VIF4:	configured VIF with extension bit (MSB) = 1
$Offs_{0-1}$:	binary value for the offset
Max_{0-1}:	binary value for the maximum (upper limit)
Anw.:	is only used by the discontinued AnDi1 to AnDi4
CS:	checksum

5.2 Respond telegram from AnDi^Plus to Master (RSP_UD)

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Name:	Start	Len	Len	Start	C	A	CI	ID_0	ID_1	ID_2	ID_3	Man_0	Man_1
Value (hex):	68	1F	1F	68	08		72					AC	48

14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Gen	Med	TC	Status	Sig_0	Sig_1	DIF1	VIF1	VIFE1	$Offs_0$	$Offs_1$	DIF2	VIF2	VIFE2	Max_0
10				00	00	02		40			02		48	

29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Max_1	DIF3	VIF3	$Mess_0$	$Mess_1$	DIF4	VIF1	$Tmpr_0$	$Tmpr_1$	DIF5	Info	$PTof_0$	$PTof_1$	CS	Stop
						66			0F					16

RSP_UD telegram

Fields analogue to SND_UD

TC: Transmission Counter (no. of transmitted RSP_UD, overflows to 0 at 256)

Status: state of application:

Bit : Reserved.
Bit6: EEPROM status History (0: ok, 1: Error is registered (see Bit3 if still active))
Bit5: range overflow
Bit4: permanent error (Device is not calibrated)
Bit3: temporary error (EEPROM checksum error)
Bit2-0: not used

VIF1=VIF2: configured VIF with extension bit (MSB) = 1

VIF3: like VIF1 with extension bit (MSB) = 0

$Mess_{0-1}$: the measured value in binary format

DIF4: DIF for the PT Temperature (0x02 normal, 0x32 function Error if no PT connected)

$Tmpr_{0-1}$: the Temperature value in binary format

Info: Byte with the following information:
Bit7: 4-20mA status (0: not used, 1: used)
Bit6: PT user correction (0: No correction, 1: user correction not 0)
Bit5: PT sensor type (0: PT100, 1: PT1000)

Bit4: (1: device selected (default))
Bit3: protection bit (1: protected)
Bit2-1: Reserved.
Bit0: operating mode (1: current, 2: voltage)

PTof 0-1: the user temperature offset value in binary format

5.3 Activating the protection

Position	1	2	3	4	5	6	7	8	9	10	11
Name.:	Start	Length	Length	Start	C	A	CI	DIF	Prot.	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	55		16

Deactivation only by button at the device (see page 5)

5.4 Switching Operating Modes

5.4.1 Switching to Volt mode

Position	1	2	3	4	5	6	7	8	9	10	11
Name.:	Start	Length	Length	Start	C	A	CI	DIF	Prot.	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	56		16

5.4.2 Switching to 0-20mA mode

Position	1	2	3	4	5	6	7	8	9	10	11
Name.:	Start	Length	Length	Start	C	A	CI	DIF	Prot.	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	57		16

5.4.3 Switching to 4-20mA mode

Position	1	2	3	4	5	6	7	8	9	10	11
Name.:	Start	Length	Length	Start	C	A	CI	DIF	Prot.	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	58		16

5.5 Set PT user correction

Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Name.:	Start	Len	Len	Start	C	A	CI	DIF	Prot.	$PTof_0$	$PTof_1$	CS	Stop
Value (hex):	68	05	05	68	53		51	0F	59				16

PTof 0-1: the user temperature offset value in binary format

6. Technical Data

6.1 General Data

Operating voltage	10–30 VDC input (recommended stable 24 VDC)
Power consumption	max. 5W
Isolation voltage	3KV
Operating temperature	0 to 55 °C
Storage temperature	-20 to 60 °C
Humidity (non-condensing)	10% to 70%
Housing	Light-Grey and black PC plastic, protective class IP30 H x W x D: 90 x 53 x 60 mm (height without terminals) Mounting on DIN rail (width: 3DU)
LED indicators	Power, Status, M-Bus
Terminals (all pluggable)	2-pin terminal for M-Bus, 2-pin terminal for power 3-pin terminal for current signal 2-pin terminal for voltage 3-pin terminal for PT100

6.2 M-Bus Data

Standard	EN13757-2, EN13757-3
Baud rate M-Bus	300, 2400 baud with auto-baud detection
Idle current M-Bus	1 unit load (max. 1.5mA)
Addressing	Primary address, secondary address with wildcards, Broadcast
Supported functions	SND_NKE, APLICATION_RESET, REQ_UD2, SND_UD

6.3 Sensors Data

ADC Resolution	12 bits
Sensor Input Range	0-20 mA (current Sensor) 0-10 V (voltage sensor)
Current sensor supply	24 VDC ±5%, current-limited to max 25 mA, short-circuit protected
PT Sensor Excitation Current	PT100: 1mA, PT1000: 0.1mA
Input current sensor resistor	160 Ohm

6.4 PT & Temperature Data

PT Temperature range	-80°C to +400°C
PT Resolution	0.175 °C
PT Sensor Excitation Current	PT100: 1mA, PT1000: 0.1mA

6.5 Ordering Information

Article Number	Description
MB AnDi Plus	M-Bus A/D converter with 0/4-20mA or 0-10V input plus PT100 or PT1000 input
NT013	Power supply 24VDC, 15W, DIN rail, input voltage 85 .. 264 VAC, 47 .. 63 Hz
NT004	Plug-in power supply, 24VDC 500mA regulated 10%