

Installation Instructions

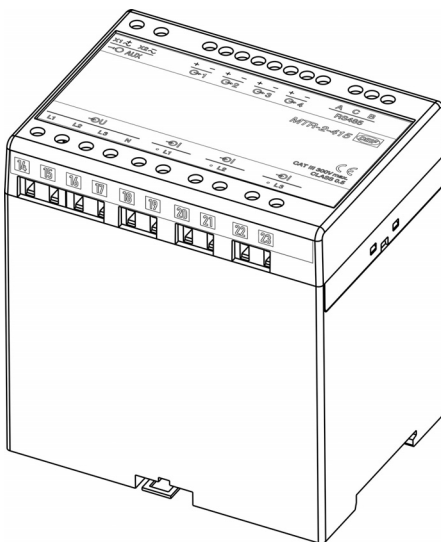


-power in control

MTR-2-015, -315, -415

Multi configurable AC transducer

4189300019A (UK)



- Voltage, current, frequency and phase angle transducer
- Supply voltage 24...300V DC or 40...276V AC
- Configuration via PC interface
- 35 mm DIN rail mounting



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1. About this document

General purpose

This document is the Installation Instructions for DEIF's MTR-2 transducer MTR-2-015, MTR-2-315 and MTR-2-415. The document mainly includes general product information and setup, mounting instructions, terminal strip overviews and I/O lists.

The general purpose of these installation instructions is to give the user important information to be used in the installation of the unit.



Please make sure that you read this manual before starting to work with the MTR-2. Failure to do this could result in damaging the equipment or even worse, injury of personnel.

Intended users

These installation instructions are mainly intended for the panel builder designer in charge. On the basis of this document, the panel builder designer will give the electrician the information he needs in order to install the MTR-2, e.g. detailed electrical drawings. In some cases the electrician may use these installation instructions himself.

2. Warnings and legal information

Legal information and responsibility

DEIF takes no responsibility for installation or operation of the switchboard. If there is any doubt about how to install or operate the MTR-2, the company responsible for the installation or the operation of the set must be contacted.

The units are not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminals against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Safety issues

Installing the unit implies work with dangerous currents and voltages. Therefore, the installation of the MTR-2 should only be carried out by authorised personnel who understands the risks involved in the working with live electrical equipment.



Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs, as this could lead to injury or death.

Notes

Throughout this document a number of notes and warnings with helpful user information will be presented. To ensure that these are noticed, they will be highlighted in order to separate them from the general text.

Note symbol



The notes provide general information which will be helpful for the reader to bear in mind.

Warning symbol

The warnings indicate a potentially dangerous situation which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.

3. General product information

Description

The MTR-2 is a fully configurable transducer for measuring of current, voltage and phase angle on AC networks. The transducer has 0 (MTR-2-015), 3 (MTR-2-315) or 4 (MTR-2-415) analogue outputs. The outputs can be configured to the following output values:

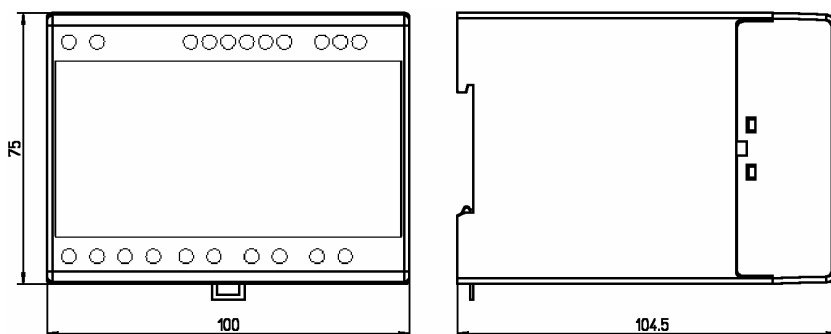
- True RMS AC voltage
 - Voltage: U_{L1-N} , U_{L2-N} , U_{L3-N} , average U_{L-N}
 - Voltage: U_{L1-L2} , U_{L2-L3} , U_{L3-L1} , average U_{L-L}
- True RMS AC current
 - Current: I_{L1} , I_{L2} , I_{L3} , ΣI , I_N , average I
- Active/reactive/apparent power
 - ΣP , $PL1$, $PL2$, $PL3$
 - ΣQ , $QL1$, $QL2$, $QL3$
 - ΣS , $SL1$, $SL2$, $SL3$
- ϕ , power factor
 - $PF1$, $PF2$, $PF3$, ΣPF (sign +/- equals CAP/IND PF)
 - $PF1$, $PF2$, $PF3$, ΣPF (sign +/- equals neg./pos. active power)
 - Angle: $UL1-L2$, $UL2-L3$, $UL3-L1$
 - Power angle: ϕ_{UL1-I1} , ϕ_{UL2-I2} , ϕ_{UL3-I3} , average ϕ

$$\left(a \tan \frac{Q}{P} \right)$$
- Frequency
 - System frequency
- THD (total harmonic distortion)
 - Current: I_{L1} , I_{L2} , I_{L3}
 - Voltage: $UL1-N$, $UL2-N$, $UL3-N$
 - Voltage: $UL1-L2$, $UL2-L3$, $UL3-L1$

- Maximum demands
 - P positive, P negative (power)
 - Q capacitive, Q inductive (CAP/IND power)
 - S (apparent power)
 - Current: IL1, IL2, IL3
- Dynamic demands
 - P positive, P negative (power)
 - Q capacitive, Q inductive (CAP/IND power)
 - S (apparent power)
 - Current: IL1, IL2, IL3

4. Mounting

Mounting instructions



The MTR-2 is designed for panel mounting, being mounted on a 35 mm DIN rail.

Weight: Approx. 0.600 kg.

The design of the transducer makes mounting of it close to similar equipment possible, however, you must make sure that there is a min. distance of 50 mm between the top and bottom of the transducer and other equipment.

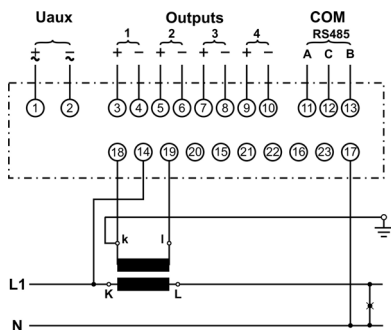
The DIN rail must always be placed horizontally when several transducers are mounted on the same rail.

5. Connections

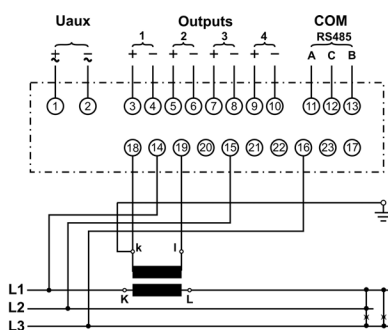
Connection table

Term. no.	Technical data	Description
Aux. power supply		
1	Supply +/-	24...300V DC or 40...276V AC
2	Supply -/~	
Analogue output 1		
3	Output 1 +	Analogue output can be set to current (0(4)...20mA) or voltage (0...10V DC)
4	Output 1 -	
Analogue output 2		
5	Output 2 +	Analogue output can be set to current (0(4)...20mA) or voltage (0...10V DC)
6	Output 2 -	
Analogue output 3		
7	Output 3 +	Analogue output can be set to current (0(4)...20mA) or voltage (0...10V DC)
8	Output 3 -	
Analogue output 4		
9	Output 4 +	Analogue output can be set to current (0(4)...20mA) or voltage (0...10V DC)
10	Output 4 -	
RS485 communication		
11	Data A	Multi drop RS485 communication connection
12	Common terminal	
13	Data B	
Voltage measuring input		
14	L1	Connection terminal for voltage measuring
15	L2	
16	L3	
17	Neutral	
Current measuring input		
18	L1 k	Connection of current transformers 1 or 5 amps
19	L1 l	
20	L2 k	
21	L2 l	
22	L3 k	
23	L3 l	

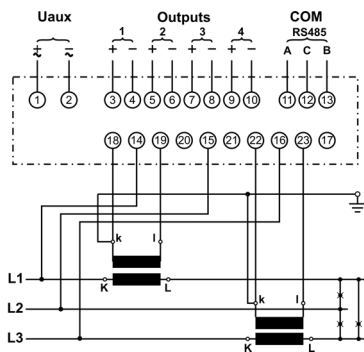
Connection diagrams



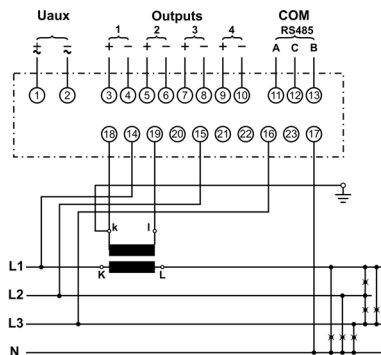
Single phase system
(1W/1b)



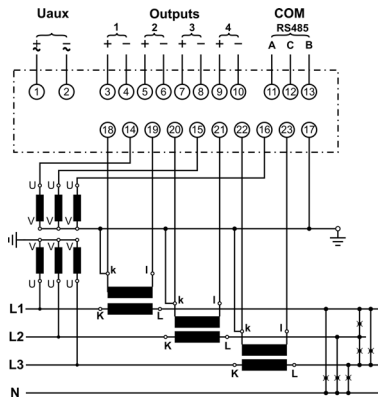
Three-phase system
3-wire balanced load
(1W3/3b)



Three-phase system
3-wire unbalanced load
(2W3/3u)



Three-phase system
4-wire balanced load
(1W4/4b)



Three-phase system
4-wire unbalanced load
(3W/4u)

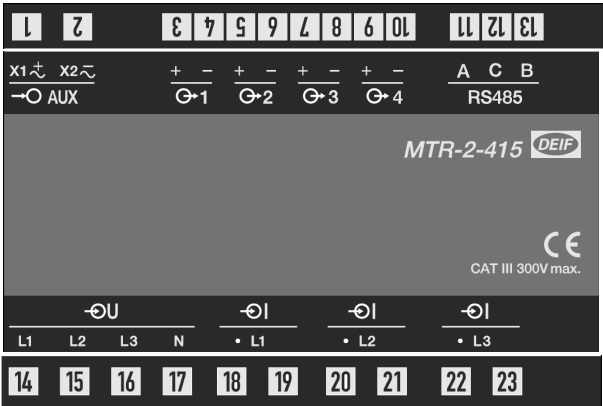
It is not necessary to protect the measuring voltage inputs, but it is recommended to use a 2A fuse for the supply input (terminals 1 and 2).

The transducer is protected against ESD (electrostatic electricity), and further special protection against this during the mounting of the transducer is not necessary.

6. Label

Label explanation

The front label of the transducer will look like this, if it is an MTR-2-415. The labels for terminal numbers are located on the sides of the transducer.



The transducer will be delivered unconfigured, so the setup label must always be filled in after setup of the transducer.

Type label

TYPE	
SUPPLY	19...300V DC / 40...276VAC (40...70Hz)
SERIAL	
Unconfigured transducer, please use configuration software to set input and output range.	
DEIF CE CLASS 0.5 300V CAT III.	

Setup label

MTR-2 No.:	G1	
	G2	
	G3	
	G4	

Description label

The type label contains information about the type of transducer and the supply voltage (aux. voltage) that must be used on the transducer. Also a unique serial number is stated on the type label.

On the setup label the left side can be removed separately. This is the description label. The description label can be used to write the description written in the setup.



DEIF's order ack. number can be found on a paper label on the transducer box.

Example: How to fill in the setup label.

MTR-2 No.: Trans 1.1	➡1	<u>4...20 mA $\approx$ 0...230 VAC U_{L1-N}</u>
	➡2	<u>0...10 VDC $\approx$ 0...5000 A I_{L1}</u>
	➡3	<u>-10...0...10 VDC $\approx$ -0,5...1...0,5 avg ϕ</u>
	➡4	<u>-10...0...20 mA $\approx$ -100...0...2 MW ΣP</u>

Output number 1:

4...20mA $\approx$ 0...230V AC U_{L1-N}

Output number 2:

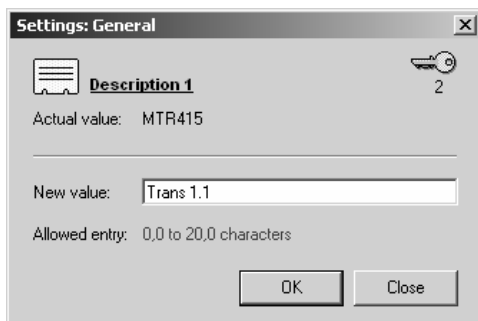
0...10V DC $\approx$ 0...5000 A I_{L1}

Output number 3:

-10...0...10V DC $\approx$ -0.5...1...0.5 avg ϕ

Output number 4:

-10...0...20mA $\approx$ -100...0...2000kW ΣP



7. Setup

System requirements

To configure the MTR-2 you will need:

- Converter RS232 to RS485 or USB to RS485
- Utility software for MTR-2 M-SET can be downloaded from www.deif.com.

The minimum requirements for the pc are:

The software is running on 32-bit Microsoft Windows operating systems including: Windows 95, Windows 98 (and Windows 98 SE), Windows Millennium Edition, Windows NT 4.0, Windows 2000, Windows XP.

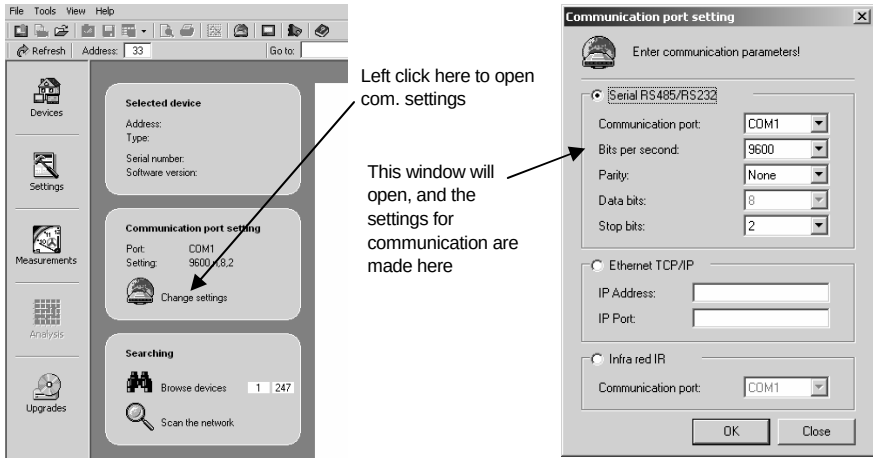
The minimum hardware configuration is the same as required for the above systems with minimum 32Mb RAM (64Mb RAM recommended).

How to configure

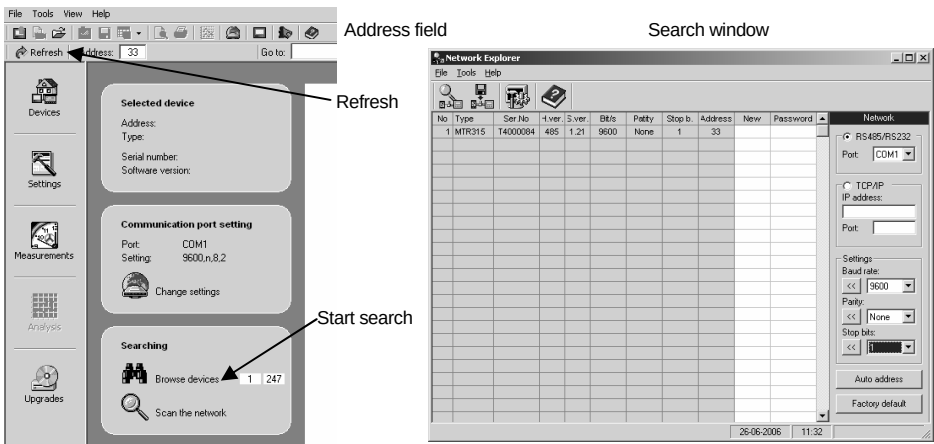
When the connection for communication has been wired up (term. 11 and 13) to the converter, term. 1 and 2 to aux. power, you are ready to start up the M-SET utility software (USW) for MTR-2.

The first thing to do is to set up the communication in the USW. If it is a new transducer, the default settings for the transducer are:

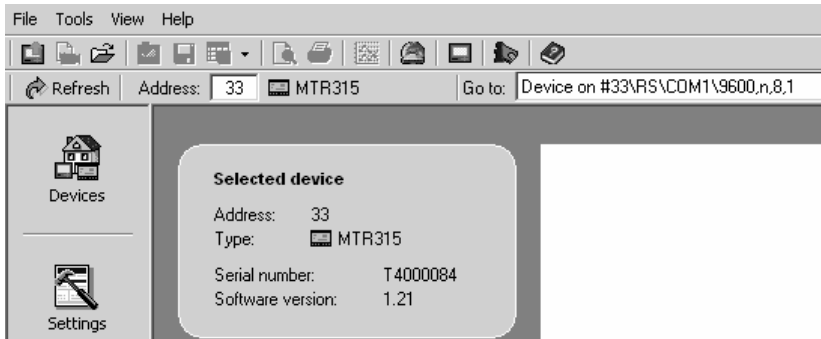
Communication speed:	9600 bit/s
Data bits:	8
Parity:	None
Stop bits:	1
Address:	33



If the slave address of the MTR-2 is known, it can be typed directly in the Address field. If the address is unknown, the search function can be used. When you left click on the Scan network icon, the search window will open.

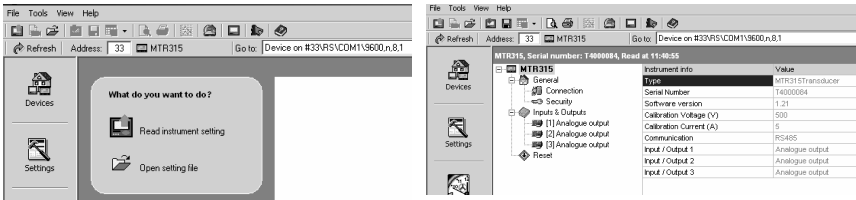


When the device address is known just enter the device number in the address field, and the Go to line will state what device you have connected to when you left click on Refresh. Also the Selected device field will show information about the connected device.



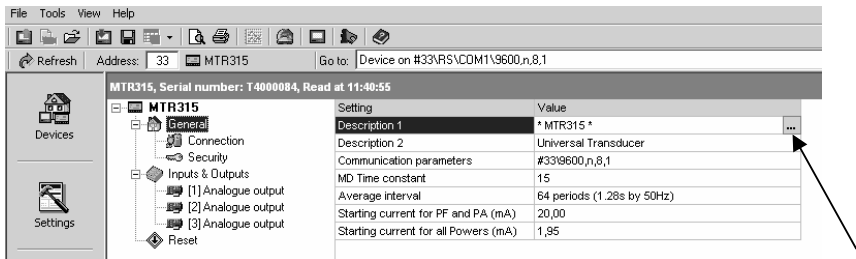
You are now connected to the MTR-2. To configure the transducer, left click on Settings. The window will change. When this new window is opened, left click on the Read instrument setting.

When the read instrument setting has been clicked, a new window will show the current settings of the connected transducer.

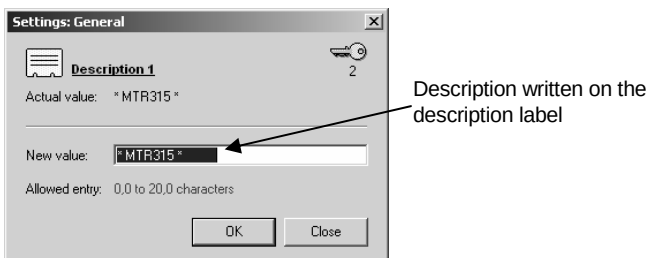


Now it works like the tree structure in Windows Explorer. When the top level is marked, the information that cannot be changed is shown like in the picture above.

When General is marked, it is possible to change the values shown below. This could e.g. be the description of the transducer.

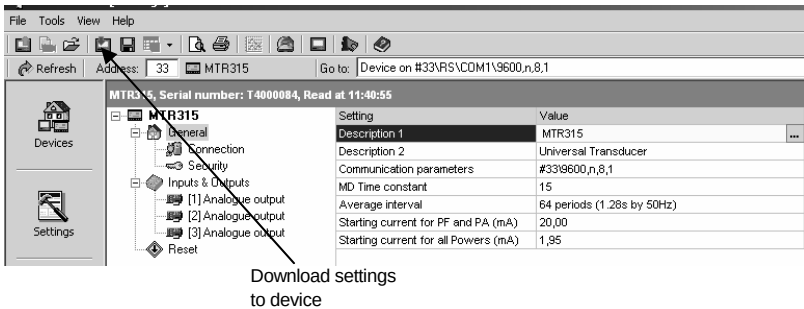


To change one of the parameters, left click on the box with three dots. Then the dialog box below will appear.

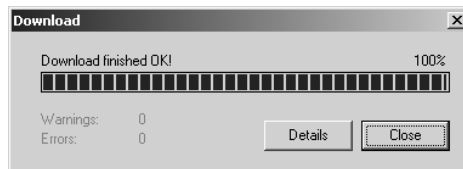


When the new value is not the same as the actual value, the line will be highlighted with bright yellow when you left click on OK.

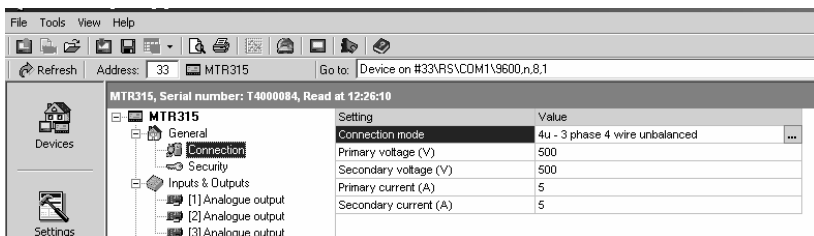
To write this new setting, in this example Description 1, left click on Download settings to device.



When this is done, the dialog box below will appear as a confirmation that the new setting is downloaded.



To set up the transducer to the actual connection of the transducer, the connection window must be opened.



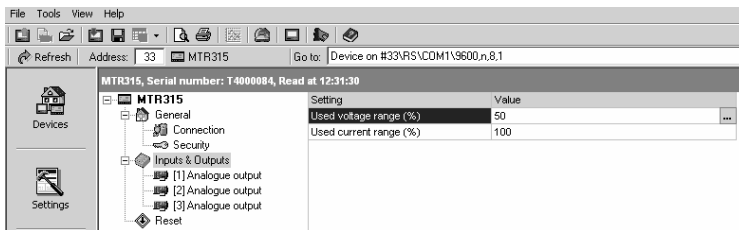
The first thing to set up is the connection modes, please see the connection diagrams to see which of the modes you have to select to match the actual installation.

Next step is to set up the primary voltage level. If no voltage transformer is present, the secondary value must be the same as the primary voltage.

The current transformer ratio must also be set up in this window, if the transducer is to be used for current or power measurements.

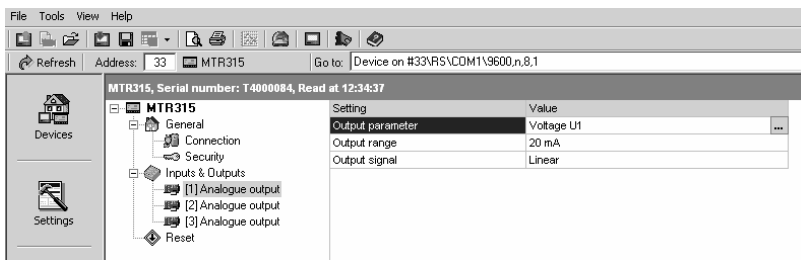
In the Security window, it is possible to set a password. The password must be typed in to be able to change the settings of the transducer.

In the Inputs & Outputs window, it is possible to set the span of the primary voltage or current that will be used when configuring the outputs.

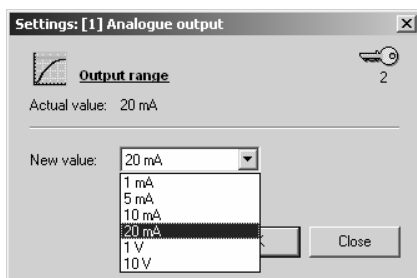


In this example, the used voltage range is set to 50%. This means that when the primary voltage is set to 500 volts, the possible max. input range is 250 volts due to this setting.

The configuration of the analogue output is done individually for each output. For configuration of output 1, open the window [1] Analogue output.

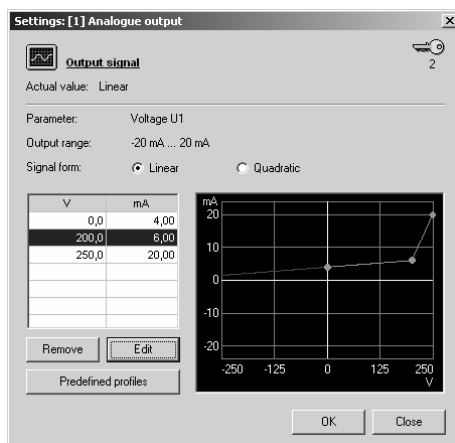
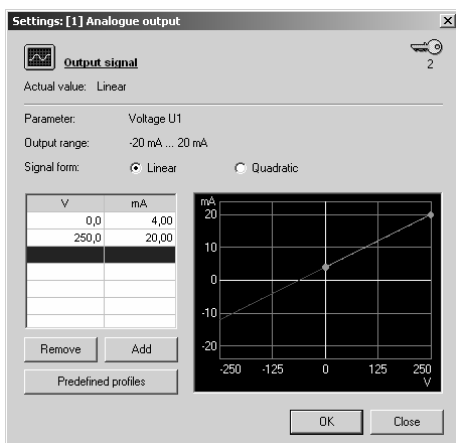


In the output parameter, the specific indication of this output is selected. In this case the analogue output 1 indicates the L_1 -N voltage. The possible selections are all mentioned under the description.



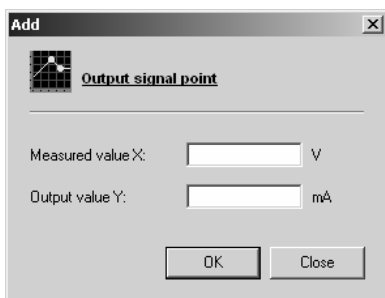
In the output range it is possible to set the maximum limit for the output. The selection is always $\pm$ the selected value. It is also in this parameter the selection between current output and voltage is done. The possible selections are shown in the dialog box above. If e.g. 20mA is selected, the range will be $\pm$ 20mA.

The Output signal parameter is where the start and end values are set. It is also possible to configure up to 5 breakpoints.

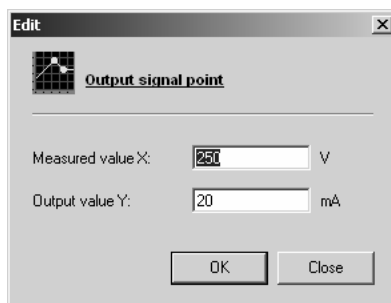


In the two examples above, the output is configured to 4...20mA. In the example to the right, an additional breakpoint has been added to make a high resolution in the area from 200V AC to 250V AC. The voltage input range is 250V AC due to the fact that the primary voltage is set to 500V AC and the Used voltage range is set to 50%. To add a breakpoint, mark an empty field in the table to the left and left click on the Add button. To change a break, start or end point, left click on the Edit button as shown in the example to the right.

If the Add or Edit button is pressed, these windows are shown.



The 'Add' window for 'Output signal point' contains two input fields. The first field, labeled 'Measured value X:', is empty and followed by a 'V' unit. The second field, labeled 'Output value Y:', is also empty and followed by a 'mA' unit. At the bottom are 'OK' and 'Close' buttons.



The 'Edit' window for 'Output signal point' contains two input fields. The first field, labeled 'Measured value X:', has the value '250' entered and is followed by a 'V' unit. The second field, labeled 'Output value Y:', has the value '20' entered and is followed by a 'mA' unit. At the bottom are 'OK' and 'Close' buttons.

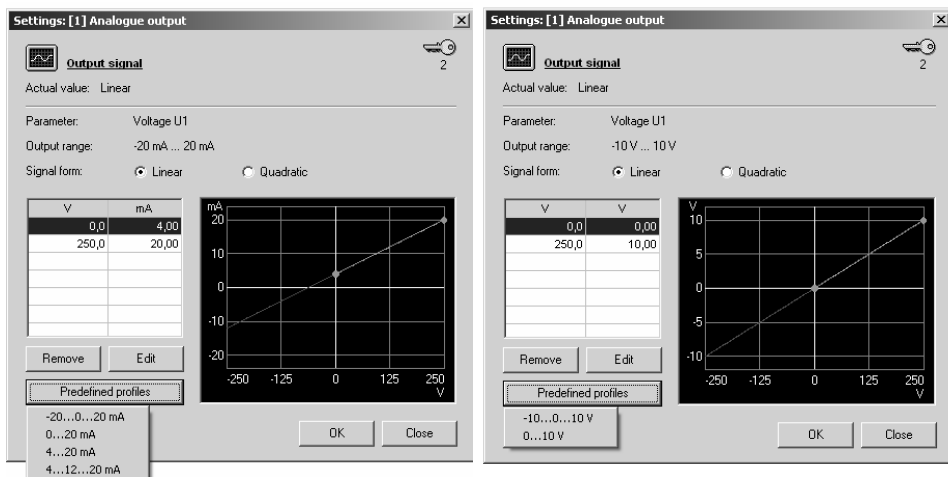
Here the new or corrected value must be typed in. When this is done, the same procedure must be done for the rest of the outputs also.



Remember to download the settings when all the settings have been done.

Predefined profiles

It is possible to choose some predefined profiles as shown below. The profile chosen below is the 4...20mA profile. If the 4...12...20mA profile is chosen, the negative area of the measuring range will also be used. This could be used in a power factor measuring.



If the voltage output is used, the predefined profiles do not have the possibility for the bias of 20% (4mA) like the current output. The profile chosen above is the 0...10V.

Save settings

When setup of the transducer has been made, all settings can be saved into a .msf file. This could be a helpful tool, if many transducers with the same setup are to be used and also for switchboard documentation. To save the settings, simply left click on the disk in the toolbar. When this is done, the dialog box below will appear. Here the .msf file is named and saved in the chosen directory.

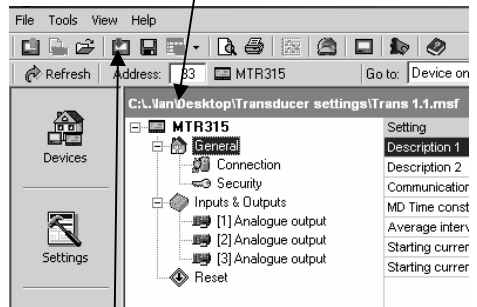
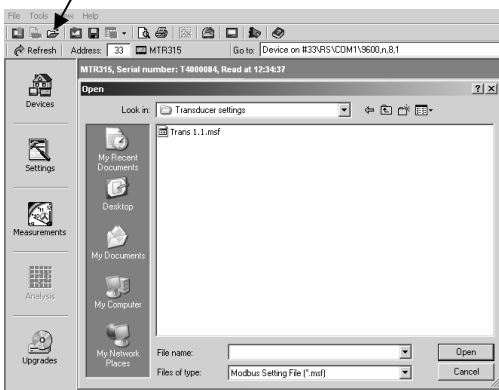
Click here to save settings



To use a .msf file to download to a transducer, just left click on the folder icon in the tool bar to open the dialog box below. Select the file you wish to download to the transducer and left click the open icon.

Open .msf file

Path to .msf file is shown here when a file is open



Download settings

8. Technical information

Technical specifications

Accuracy according to EN 60688:

Voltage RMS:

Phase to neutral voltages U1, U2, U3 and average phase to neutral voltage $U_{avg}(pn)$	0.5 c
Phase to phase voltages U1-U2, U2-U3, U3-U1 and average phase to phase voltage $U_{avg}(pp)$	1.0 c

Current RMS:

Phase current I1, I2, I3 and average current I_{avg}	0.5 c
Neutral current I_n	1.0 c

Frequency RMS:

System frequency	0.2 c
Input frequency range $\leq 10\text{Hz}$	0.1 c

Phase angle:

Angle between phase U and I and power angle total	$\pm 0.2^\circ$ c
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Power factor:

Input range 50mA...6A, 10...600V	$0.2 \pm 0.5^\circ$ c
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System:

Active, reactive and apparent power	0.5 c
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Dynamic demand values:

Phase current (I1, I2 or I3), apparent power total (St)	
Active power total (Pt) (positive or negative)	
Reactive power total (Qt) (L or C)	1 c

Maximum demand values:

Phase current (I1, I2 or I3), apparent power total (St)	
Active power total (Pt) (positive or negative)	
Reactive power total (Qt) (L or C)	1 c

If power supply is interrupted more than 1 second, all demand calculations will be lost.

c (correction factor) behind the accuracy class means that the actual accuracy class can be calculated by multiplying the accuracy class with the c factor. The c factor can be calculated by means of the formula below.

Intrinsic error (for analogue outputs)

The intrinsic curves are used to calculate the actual accuracy class in this configuration that is done on your transducer, so you will know if you can expect a better accuracy than in the specification.

For intrinsic error for analogue outputs with bent or linear zoom characteristic, multiply the accuracy class with the correction factor (c).

Correction factor c (the highest value applies):

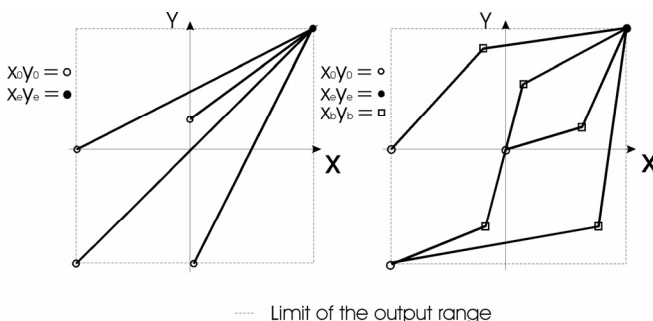
Linear characteristic

$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} \quad \text{or} \quad c = 1$$

Bent characteristic

$x_{b-1} \leq x \leq x_b$ b – number of break point (1 to 5)

$$c = \frac{y_b - y_{b-1}}{x_b - x_{b-1}} \cdot \frac{x_e}{y_e} \quad \text{or} \quad c = 1$$



Calculation example for intrinsic curves:

In this example, the output is to current output 4mA corresponding to 45Hz and 20mA corresponding to 55Hz.

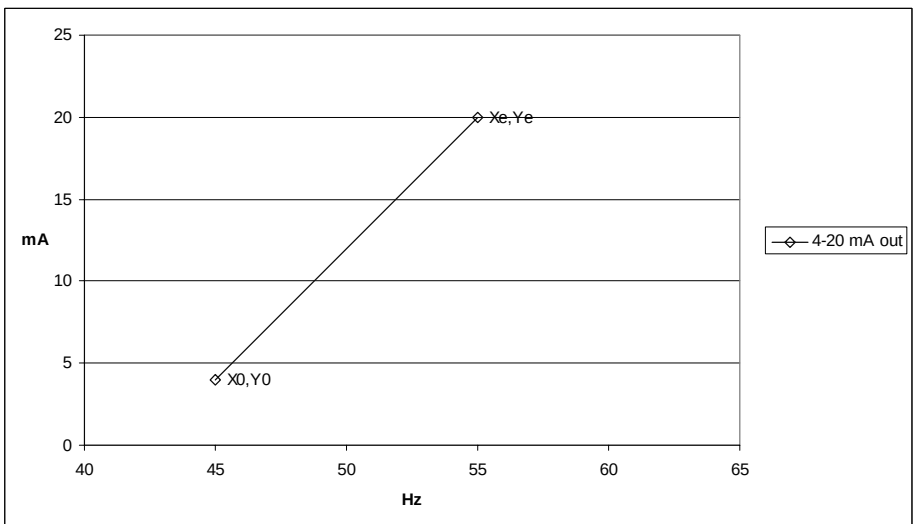
$$y_0 = \frac{4}{20} \cdot 100 = 20 \% \quad y_e = \frac{20}{20} \cdot 100 = 100 \%$$

$$x_0 = \frac{45 - 45}{65 - 45} \cdot 100 = 0 \%$$

$$x_e = \frac{55 - 45}{65 - 45} \cdot 100 = 50 \%$$

$$c = \frac{1 - \frac{y_0}{y_e}}{1 - \frac{x_0}{x_e}} = \frac{1 - \frac{20}{100}}{1 - \frac{0}{50}} = 0,8$$

System frequency accuracy: $0,2 \cdot 0,8 = 0,16$



Technical specifications

Meas. current (I_n):	0.0...0.5 - 5.0A
Overload, currents:	2 x I_n max., continuously 20 x I_n max. for 1 s
Load:	Max. 0.3VA
Meas. voltage (U_n):	50...500V phase to neutral
Connection:	Star connection (UL1-N): 50V...500V AC Delta connection (UL1-L2): 87V...866V AC
Overload, voltages:	1.2 x U_n max., continuously 2 x U_n max. for 10 s
Load:	Max. 0.1VA
Frequency range:	45...65Hz
Output:	0 analogue output MTR-2-015 3 analogue output MTR-2-315 4 analogue output MTR-2-415
Output range:	Output (0...100%): Current: 0...1mA, 0...20mA Voltage: 0...1V, 0...10V Upper and lower limit can be set to any value in the span Output (-100...0...100%): Current: -20...0...20mA Voltage: -10...0...10V Upper and lower limit can be set to any value in the span

Communication:	RS485 Modbus RTU multi drop 32 drops per link
Data rate:	1200...115200 bits/s
Limit:	±120% of nominal output
Output load:	Current: Max. 15V (R_B max. 0.75 k Ω @ 20 mA) Voltage: Max. 20mA (R_B min. 0.5 k Ω @ 10 V)
Output cable:	Max. length 30m
Ambient temperature:	0...45°C (nominal) -40...70°C (storage)
Annual mean r.h.:	≤ 93% relative humidity
Response time:	< 300ms
Residual ripple:	< 1% peak to peak
Galvanic separation:	Test voltage 4.0 kV
Supply voltage:	Multi aux. voltage: 19...300V DC or 40...276V AC 40...70Hz
Consumption:	(Aux. supply) < 3.0VA
Climate:	Climate class 2 according to EN60688: 1989
EMC:	According to EN 61326-1 1997 EN61000-6-1 EN61000-6-2 EN61000-6-3 EN61000-6-4
Protection:	Housing: IP50 Terminals: IP20 to EN 60529

Connections:	Current and voltage measurement:
	Max. 2 x 2.5mm ² multi-stranded
	Max. 4.0mm ² single-stranded
	Analogue outputs communication and aux. supply:
	Max. 2.5mm ² multi-stranded
	Max. 2.5mm ² single-stranded
Materials:	PC/ABS non-flammable according to UL 94 V-0
Weight:	0.600kg

DEIF A/S reserves the right to change any of the above