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Data Sheet

055.9e

Multi-Functional Transducer for Currents, Voltages, Power

MMU 3.0

WEIGEL

Application

The multi-functional transducer **MMU 3.0** accepts any measurable quantity in existing single-phase or three-phase power supply systems, converts these input signals into a load independent DC current and/or impressed DC voltage (current and voltage are synchronous on analog output 1) and issues the measured values parametrically to an interface RS 232 and RS 485. A digital output is also available in the basic version. Transducers with additional analog outputs (voltage or current programmable) and/or four resp. eight additional digital outputs are optionally available.

Inputs (exept 10 V measuring input) are galvanically isolated from outputs and the auxiliary voltage input. The outputs are short-circuit proof and safe against idling.

The transducers comply with the safety requirements and are tested for interference immunity.

The transducers are designed to be mounted in machines/systems. Regulations for installation of electrical systems and equipment have to be observed.

Measurement

The multi-functional transducer processes input currents up to 5 A and input voltages up to 519 V at rated frequencies of 50 Hz and 60 Hz. Depending on the measurement task, input terminals not required remain idle.

Measurement is effected in **true RMS-values** including wave forms **up to the 50th harmonics**.

Analog Outputs

Any of the measurable quantities (current, voltage, active-, reactive-power, frequency etc.) can be allocated to each of the analog outputs.

The analog output available in the basic version synchronously provides voltage and current (4 terminals). The output signal of each of the optional analog outputs can be parametrized freely (0/4 ... 20 mA, 0/2 ... 10 V, –10 ... 10 mA; linear or **buckled** characteristic curve).
Selection between current or voltage output is effected by software.

It is possible to connect more than one indicator, recorder or controller to the output circuit provided the total impedance does not exceed the rating.

RS 232/485

The transducers are equipped with both a RS 232 and a RS 485 interface enabling to request measured values and to perform adjustments. When using the RS 485 interface, up to 32 devices can be networked and read out via a 2-wire line (1000 m maximum length).

Digital Outputs

The digital outputs can be used as switching contacts for setpoint controlling.

Auxiliary Supply

Power supply is effected by a separate auxiliary voltage input.

Software

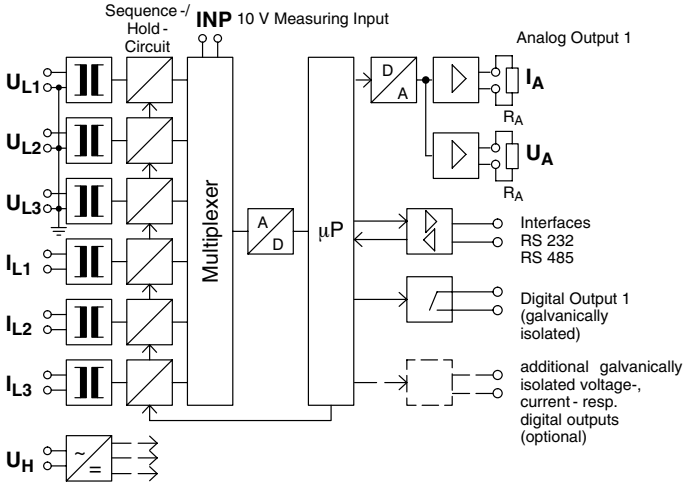
The software **WSoft** ready for execution on Windows® 95/98/2000/XP is available for control of functions and for read-out of measured values. The control is effected by the widespread machine language **SCPI**.

Operating Principle

Transformers in the current and voltage circuits galvanically isolate the power inputs from the electronic circuitry. Hold-/sequence-circuits process the input signals and transfer them via a multiplexer and a AD-converter to the microprocessor which processes the signals and computes all important measuring quantities.

The transducer is connected to the PC via a commercially available RS232 cable (9-contact 1:1 connection, socket-plug. An optional connection will be a 3-contact cable provided the signals DTR and DSR as well as RTS and CTS will be two-way bridged.)

Block Circuit Diagram



General Technical Data

case details	projecting case clamping to TH 35 DIN rail according to DIN EN 60 715
material of case	Cycoloy C2950 black self-extinguishing to UL rating 94 V–0
terminals	screw-terminals, maximum torque 0.8 Nm
wire cross-section	4 mm^2 max.
enclosure code	IP 40 case IP 20 terminals
dielectric test	
2210 V 3536 V	all circuits to case currents to each other and to voltages; inputs (exept 10 V measuring input) to outputs, auxiliary voltage and interfaces; auxiliary voltage to outputs and interfaces;
1000 V=	outputs to each other (the analog output 1 is galvanically connected to 10 V measuring input and to interfaces.)
operating voltage	300 V (rated voltage phase to zero)
class of protection	II
measurement category	CAT III
pollution level	2
dimensions	basic version: 3 modules in single-phase system resp. 4 modules in three-phase systems, optional outputs: additional 1 to 3 modules
each module WxHxL	22.5 mm x 80 mm x 115 mm
weight	approx. 0.6 kg (basic version)

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Inputs

input quantities	AC current and AC voltage
voltages	L1, L2, L3 (3 terminals), N (1 terminal)
currents	I1, I2, I3 (6 terminals)
auxiliary supply	U_H (2 terminals)
10 V measurement input	e.g. connecting an analog converter
rated input current I_{EN}	N/5 A ⧫
rated input voltage U_{EN}	519 V (inter-connected) ⧫
operating voltage	519 V max.
modulation range	1.2 U_{EN} and 1.2 I_{EN}
overload limits	1.2 U_{EN}, 1.6 I_{EN} continuously 2 U_{EN}, 10 I_{EN} max. 1 s
frequency range	50 ... 60 Hz
power consumption	2 mA ±10% each voltage circuit ≤ 0.1 VA each current circuit for I_{EN} = 1 A ≤ 1.6 VA each current circuit for I_{EN} = 5 A

Measuring Quantities

Measuring Quantity	Total	L1	L2	L3
voltage (U)	U	U_1	U_2	U_3
current (I)	I [1])	I_1	I_2 [1])	I_3
active power (P)	P	P_1	P_2 [1])	P_3
reactive power (Q)	Q	Q_1	Q_2 [1])	Q_3
apparent power (S)	S	S_1	S_2 [1])	S_3
active factor (PF)	PF	PF_1	PF_2 [1])	PF_3
reactive factor (QF)	QF	QF_1	QF_2 [1])	QF_3
phase angle (PH)	PH	PH_1	PH_2 [1])	PH_3
frequency (f)		F		

Depending on power system, it will not be possible to measure all these values.

10 V measuring input	INP	(±10 V)

Outputs

Outputs ⧫

analog output 1	voltage & current synchronous (2 terminals each)
interfaces	RS 232 (SUB–D jack) RS 485 (2 terminals)

(All outputs listed above and the analog input have one and the same potential.)

digital output	contact-free via opto coupler, max. 230 V / 100 mA, internal resistance 25 ... 35 Ω, insulation voltage 2.3 kV, switching frequency admissible ≤2 Hz

1, 2, or 3 additional analog outputs (galvanically isolated) and up to 8 additional digital outputs (galvanically isolated) are optional ⧫

response time based on 50 Hz	≤ 500 ms, exception for 3-phase 3-wire unbalanced load system for quantities marked with [1]) (see table **Measuring Quantities**): ≤ 750 ms
additional response time for serial output	20 ms for each value (RS 232/485, 19,200 baud)

⧫ refer also to **Extras**

current output

output current	I_A	load independent DC current
rated current	I_{AN}	0 (4) ... 20 mA or 0 ... 10 mA (parameterizable)
load range	R_A	0 ... 500 Ω (based on 20 mA) 0 ... 1000 Ω (based on 10 mA)
load error		≤ 0.1% based on 50% load change
residual ripple		≤ 1%$_{rms}$ of I_{AN} with load R_A
idling voltage		≤ 16 V
current limitation		up to 24 mA

voltage output

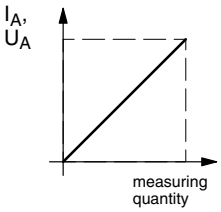
output voltage	U_A	load independent DC voltage
rated voltage	U_{AN}	0 (2) ... 10 V (parameterizable)
load	R_A	≥ 4 kΩ (based on U_{AN})
load error		≤ 0.1% based on 50% load change
residual ripple		≤ 1%$_{rms}$ of U_{AN} with load R_A = U_{AN} / 2 mA
idling voltage		≤ 16 V
voltage limitation		up to 12 V

Inputs (exept 10 V measuring input) and outputs are galvanically isolated.

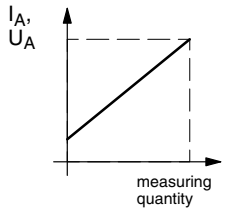
Conversion Characteristics

examples

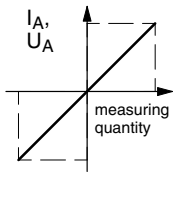
standard

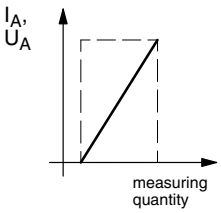


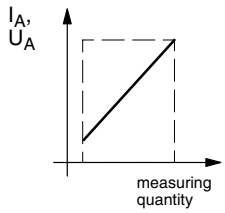
"live zero"

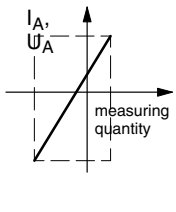


incoming and outgoing

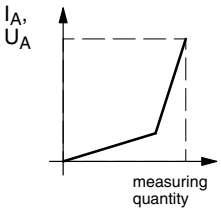


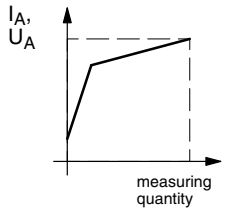


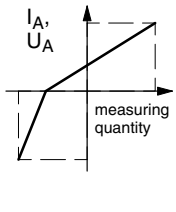




buckled characteristic curve







Interfaces

type	RS 232 (V.24) and RS 485 (SCPI commands)
Baud rate	19200 Baud
data bit	8
parity	none
stop bit	2

Auxiliary Supply

auxiliary voltage U_{HN}	**wide-range supply** 20 ... 90 V DC resp. 15 ... 65 V AC, 90 ... 357 V DC resp. 65 ... 253 V AC
power consumption	< 10 VA

Accuracy at Reference Conditions

accuracy	better than **class 0.5** (±0.5% of end value) exception for 3-phase 3-wire unbalanced load system for quantities marked with [1]) (see table **Measuring Quantities**) These ratings are calculated values (Aron circuit): **class 1.5** (±1.5% of end value)
temperature coefficient	≤ 0.06%/K

valid for standard products and a life-period of 1 year maximum

reference conditions

input current	I_{EN} ±0.5%
input voltage	U_{EN} ±0.5%
power factor	cos φ =1
frequency	50 Hz
wave form	sine wave, distortion factor ≤ 1%
auxiliary voltage	U_{HN} ±1%, 48 ... 62 Hz
load	0.5 $R_{A\ max}$ ±1% based on current 10 kΩ ±1% based on voltage
ambient temperature	23°C ±1K
warm-up	≥5 min

Environmental

climatic suitability	climatic class 3 to VDE/VDI 3540 sheet 2
operating temperature range	–10 ... +55°C
storage temperature range	–25 ... +65°C
relative humidity	≤ 75% annual average, non-condensing

Rules and Standards

DIN EN 60 529	Enclosure codes by housings (IP-code)
DIN EN 60 688	Electrical measuring transducers converting AC quantities into analog or digital signals
DIN EN 60 715	Dimensions of low voltage switching devices: standardized DIN rails for mechanical fixation of electrical devices in switchgears
DIN EN 61 010-1	Safety requirements for electrical measuring, control and laboratory equipment Part 1: General requirements
DIN EN 61 326-1	Electrical equipment for measurement, control and laboratory use – EMC requirements Part 1: General requirements (IEC 61 000-4-3 evaluation criterion B)
VDE/VDI 3540 sheet 2	Reliability of measuring and control equipment (classification of climates for equipment and accessories)

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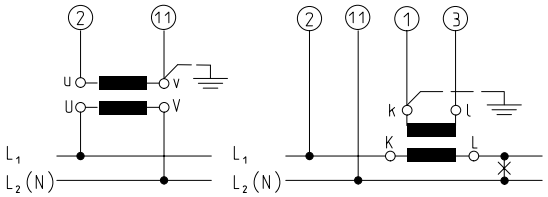
Multi-Functional Transducer for Currents, Voltages, Power

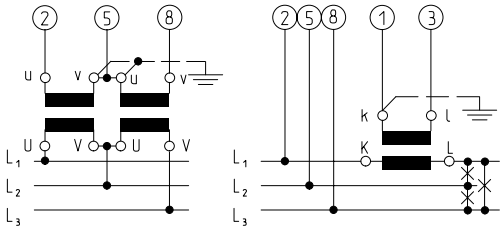
Connections

input

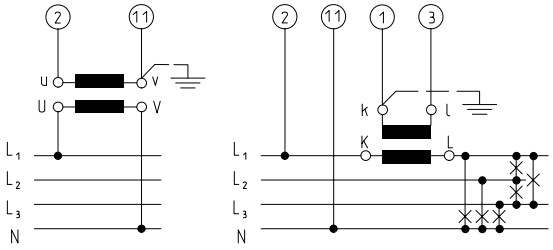
active and reactive power, single-phase



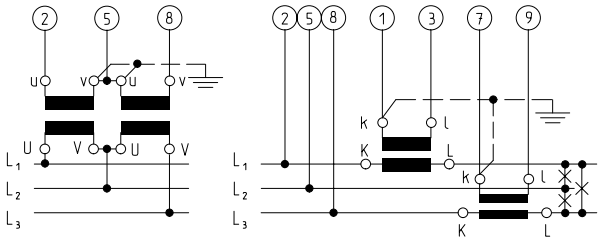
active and reactive power, 3-phase, 3-wire, balanced load



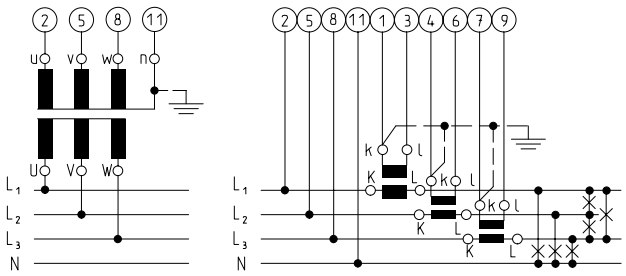
active and reactive power, 3-phase, 4-wire, balanced load



active and reactive power, 3-phase, 3-wire, unbalanced load

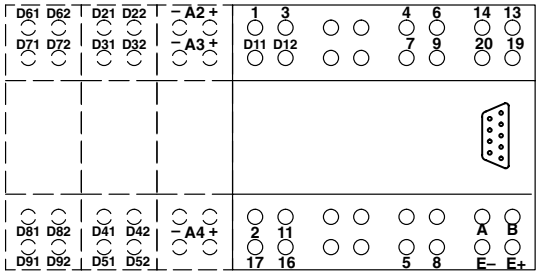


active and reactive power, 3-phase, 4-wire, unbalanced load



Terminals

front view



digital outputs 6 to 9 | digital outputs 2 to 5 | analog outputs 2 to 4 | basic version for 3-phase network (one module inapplicable for single-phase network)

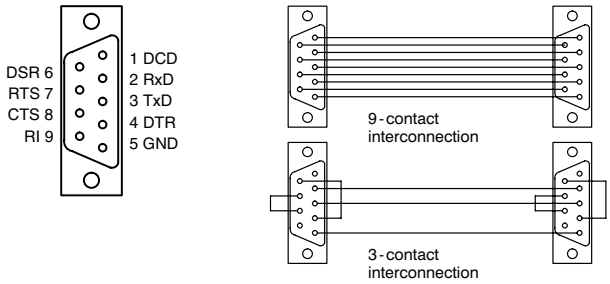
terminal	MMU 3.0
1	I_E L_1
2	U_E L_1
3	I_E L_1
4	I_E L_2
5	U_E L_2
6	I_E L_2
7	I_E L_3
8	U_E L_3
9	I_E L_3
11	U_E N
13	U_{A1} (+)
14	U_{A1} (–)
16	U_H L_1 (+)
17	U_H N (–)
19	I_{A1} (+)
20	I_{A1} (–)
E+	U_E (+)
E–	U_E (–)
A	RS 485
B	RS 485
SUB-D	RS 232
Dn1	digital output n, contact 1, (n = 1 ... 9)
Dn2	digital output n, contact 2, (n = 1 ... 9)
Am–	analog output m, negative pole, (m = 2 ... 4)
Am+	analog output m, positive pole, (m = 2 ... 4)

Depending on the measurement task, input- resp. output-terminals remain idle.

I_E current input
U_E voltage input
The numbers on the terminals correspond to details in connection diagrams (refer to DIN 43 807).

I_A current output
U_A voltage output
U_H auxiliary voltage input

RS232-Interconnection



Extras

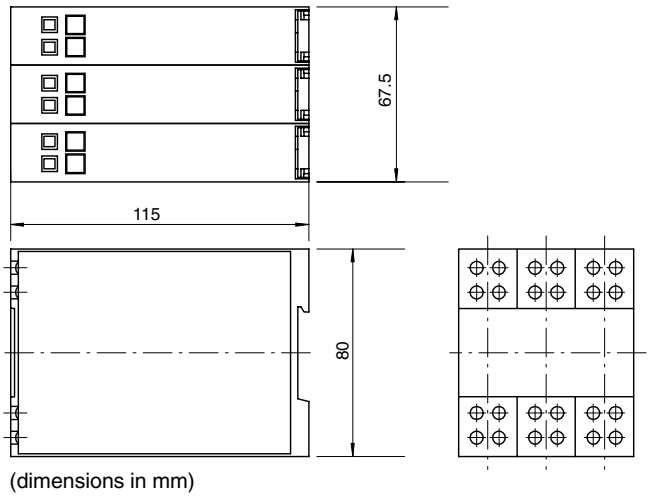
outputs

1, 2 or 3 additional analog outputs	can be parametrized via software between 20 mA (load<500 Ω) and 10 V (load >4 kΩ); galvanically isolated, power supply unit integrated (width: 1 module)
4 or 8 additional digital outputs	230 V, galvanically isolated (width: 1 resp. 2 modules)
rated input current I_{EN}	N/1.2 A (also programmable for N/1 A, with same accuracy)
rated input voltage U_{EN}	N/120 V (inter-connected) (also programmable for N/100 V or N/110 V, with same accuracy)

Dimensions

example: basic version with 3 modules, width: each module 22.5 mm

side view front view



(dimensions in mm)

Ordering Guide

type	multi-functional transducer for currents, voltages, power
	MMU 3.0
E	basic version for single-phase AC
D	basic version for 3-phase network
	outputs *)
	analog output 1 (voltage & current synchronous)
	digital output 1
	analog outputs
A1	1 additional analog output with basic version
A2	2 additional analog outputs with basic version
A3	3 additional analog outputs with basic version
Ax	additional analog outputs with basic version **)
	digital outputs
D4	4 additional digital outputs with basic version
D8	8 additional digital outputs with basic version
	auxiliary supply
H4	DC 20 ... 90 V / AC 15 ... 65 V
H5	DC 90 ... 357 V / AC 65 ... 253 V
	programming
P0	by user *)
P1	by factory

	accessory
WSoft	software on CD for configuration and read-out of measured values
RS 232 – RS 232 cable (serial connection cable)	
USB – RS 232 converter with cable (1.8 m)	
AP-RS232/485	RS 232-485 converter

*) standard
**) on request

Note: Data relating to input, measuring range and to the output assignment are not required, as the transducers are suitable to be configured with a PC or laptop.

ordering example

MMU 3.0	D D4 H5 P0 WSoft

multi-functional transducer for use on 3-phase network
(1 analog output and 1 digital output included),
not any additional analog outputs,
4 additional digital outputs,
auxiliary voltage DC 90 ... 357 V / AC 65 ... 253 V,
user-programming; software WSoft

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– specifications subject to change without notice; date of issue 1/11 –