RISHABH

Data Sheet

RISH Ducer M01

Programmable multi-transducer

RoHS CE

Measure Control Record Analyze Optimize

Application

for the measurement of electrical variables in heavy current power systems

RISH Ducer M01 (Fig. 1) is a programmable transducer with **RS 485 bus interface (MODBUS)**®. It supervises several parameter of an electrical power system simultaneously.

The RS 485 interface enables the user to determine the number variables to be supervised (up to the maximum available). The levels of all internal counters that have been configured (max. 4) can also viewed. Provision is made for programming the RISH Ducer M01 via the bus. A standard EIA 485 interface can be used. The transducers are also equipped with an RS 232 serial interface to which a PC with the corresponding software can be connected for programming or accessing and executing useful ancillary functions.

This interface is needed for bus operation to configure the device address, the Baud rate and possibly increasing the message waiting time (if the master is too slow) defined in the MODBUS® protocol.

The usual methods of connection, the types of measured variables, their ratings and the type of internal energy/metering are the main parameters that can be programmed.

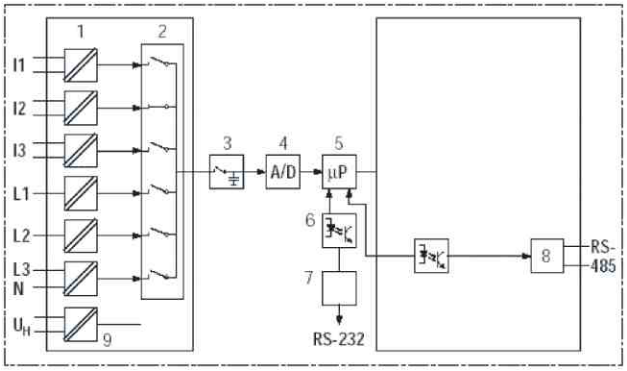
The ancillary functions include a power system check and a facility for printing nameplates.

The transducer fulfils all the essential requirements and regulations concerning electromagnetic compatibility (EMC) and safety (IEC 1010 resp. EN 61 010). It was developed and is manufactured and tested in strict accordance with the quality assurance standard ISO 9001.

Features

- Simultaneous measurement of several variables of a heavy-current power system / full supervision of an asymmetrically loaded four-wire power system, rated current 1 to 6 A, rated voltage 57 to 400V (phase to neutral) or 100 to 693V (phase-to-phase)
- For all heavy-current power system variables
- Input voltage up to 693 V (phase-to-phase)
- Universal analogue outputs (programmable)
- Transfer of data via MODBUS® interface
- High accuracy: U/I 0.2%, (under reference conditions)
- Universal digital outputs (meter transmitter, limits)
- 4 integrated energy meters, storage every each 203 s, storage for : 20 years
- Windows software with password protection for programming, data analysis, power system status simulation, acquisition of meter data and making settings
- DC-, AC- power pack with wide power supply tolerance /universal Provision for either snapping the transducer onto top - hat rails or securing it with screws to a wall or panel

Measured variables	Output	Types
Current, Voltage (rms), active/reactive/apparent power Cosφ, sinφ, power factor RMS value of the current with wire setting range (bimetal measuring function) Slave pointer function for the measurement of the RMS value IB Frequency Average value of the currents with sign of the active power (power symbol only)	**Without analogue outputs, with bus interface RS 485 (MODBUS)**	Ducer **M01**
	4 analogue and bus interface RS 485 (MODBUS)	Ducer **M40**
	2 analogue and 4 digital outputs or	Ducer **M24**
	4 analogue and 2 digital outputs see Data sheet	Ducer **M42**
	Data bus LON see Data Sheet M00	Ducer **M00**



1 = Input transformer
2 = Multiplexer
3 = Latching stage
4 = A/D converter
5 = Microprocessor
6 = Electrical insulation
7 = Programming interface RS-232
8 = Bus RS 485 (MODBUS)
9 = Power supply

Fig. 2. Block diagram.

The RS 485 interface of the M01 is galvanically isolated from all other circuits. For an optimal data transmission the devices are connected via a 3 - wire cable, consisting of a twisted pair cable (for data lines) and a shield. There is no termination required. A shield both prevents the coupling of external noise to the bus and limits emissions from the bus. The shield must be connected to solid ground.

You can connect up to 32 members to the bus (including master).

Basically devices of different manufacturers can be connected to the bus, if they use the standard MODBUS® protocol. Devices without galvanically isolated bus interface are not allowed to be connected to the shield.

The optimal topology for the bus is the daisy chain connection from node 1 to node 2 to node n. The bus must form a single continuous path, & the nodes in the middle of the bus must have short stubs. Longer stubs would have a negative impact on signal quality (reflection at the end). A star or even ring topology is not allowed.

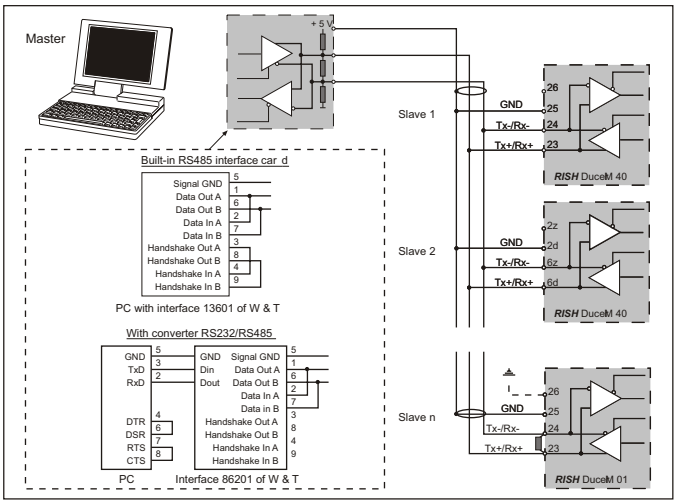


Fig. 4

There is no bus termination required due to low data rate. If you got problems when using long cables you can terminate the bus at both ends with the characteristic impedance of the cable (normally about 120 Ω). Interface convertors RS232 ⇔ RS485 or RS564 interface cards often have a built-in termination network which can be connected to the bus. The second impedance then can be connected directly between the bus terminals of the device far most.

Fig. 4 shows the connection of transducers M01 to the MODBUS. The RS 485 interface can be realized by means of PC built - in interface cards or interface converters. Both is shown using i.e. the interfaces 13601 and 86201 of W & T (Wiesemann & Theis GmbH). They are configured for a 2-wire application with automatic control of data direction. These interfaces provide a galvanical isolation and a built-in termination network.

Important:

- Each device connected to the bus must have a unique address

- All devices must be adjusted to the same baudrate.

Symbols and their meaning

Symbols	Meaning
X	Measured variable
X0	Lower limit of the measured variable
X1	Break point of the measured variable
X2	Upper limit of the measured variable
Y	Output variable
Y0	Lower limit of the output variable
Y1	Break point of the output variable
Y2	Upper limit of the output variable
U	Input voltage
Ur	Rated value of the input voltage
U 12	Phase-to-phase voltage L1 - L2
U 23	Phase-to-phase voltage L2 - L3
U 31	Phase-to-phase voltage L3 - L1
U1N	Phase-to-neutral voltage L1 - N
U2N	Phase-to-neutral voltage L2 - N
U3N	Phase-to-neutral voltage L3 - N
UM	Average value of the voltages
	(U1N + U2N + U3N) / 3
I	Input current
I1	AC current L1
I2	AC current L2
I3	AC current L3
Ir	Rated value of the input current
IM	Average value of the currents (I1+ I2 + I3) / 3
IMS	Average value of the currents and sign of the active power (P)
IB	RMS value of the current with wire setting range (bimetal measuring function)
IBT	Response time for IB
BS	Slave pointer function for the measurement of the RMS value IB
BST	Response time for BS
φ	Phase-shift between current and voltage
F	Frequency of the input variable
Fn	Rated frequency
P	Active power of the system P=P1+P2 + P3
P1	Active power phase 1 (phase-to-neutral L1 - N)
P2	Active power phase 2 (phase-to-neutral L2 - N)
P3	Active power phase 3 (phase-to-neutral L3 - N)

Symbols	Meaning
Q	Reactive power of the system Q = Q1+ Q2 + Q3
Q1	Reactive power phase 1 (phase-to-neutral L1-N)
Q2	Reactive power phase 2 (phase-to-neutral L2-N)
Q3	Reactive power phase 3 (phase-to-neutral L3-N)
S	Apparent power of the system $S = \sqrt{I_1^2 + I_2^2 + I_3^2} \bullet \sqrt{U_1^2 + U_2^2 + U_3^2}$
S1	Apparent power phase 1 (phase-to-neutral L1-N)
S2	Apparent power phase 2 (phase-to-neutral L2-N)
S3	Apparent power phase 3 (phase-to-neutral L3-N)
Sr	Rated value of the apparent power of the system
PF	Active power factor cos φ =P/S
PF1	Active power factor phase1 P1/S1
PF2	Active power factor phase2 P2/S2
PF3	Active power factor phase3 P3/S3
QF	Reactive power factor sin j =Q/S
QF1	Reactive power factor phase1 Q1/S1
QF2	Reactive power factor phase2 Q2/S2
QF3	Reactive power factor phase3 Q3/S3
LF	Power factor of the system LF = sgnQ (1- PF)
LF1	Power factor phase 1 sgnQ1 (1 - PF1)
LF2	Power factor phase 2 sgnQ2 (1 - PF2)
LF3	Power factor phase 3 sgnQ3 (1 - PF3)
H	Power supply
Hn	Rated value of the power supply
CT	c.t. ratio
VT	v.t. ratio

Technical Data

Input

Input variables	see Table 3 and 4
Measuring ranges	see Table 3 and 4
Waveform	Sinusoidal
Rated frequency	50...60 Hz; 16 2/3 Hz
Own consumption [VA]	Voltage circuit: ≤ U^2/ 400 k OHM Condition: Characteristic XH 01...XH10 Current circuit: ≤ I2 0.01 OHM

Continuous thermal ratings of inputs

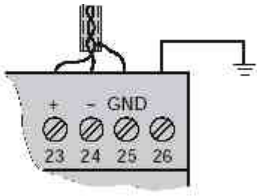
Current circuit	10A	400 V single-phase AC system 693 V three-phase system
Voltage circuit	480V 831V	single-phase AC system three-phase system

Short-time thermal rating of inputs

Input variable	Number of inputs	Duration of overload	Intervall between two overloads
Current circuit	400 V single-phase AC system 693 V three-phase system		
100 A	5	3 s	5 min.
250 A	1	1 s	1 hour
Voltage circuit	1 A, 2 A, 5 A		
Single-phase AC system 600 V H_{intern}: 1.5 Ur	10	10 s	10 min.
Three-phase system 1040 V H_{intern}: 1.5 Ur	10	10 s	10 s

MODBUS® (Bus interface RS-485)

Terminals	Screw terminals, terminals 23, 24, 25 and 26
Connecting cable	Screened twisted pair
Max. distance	Approx. 1200 m (approx. 4000 ft.)
Baudrate	1200 … 9600 Bd (programmable)
Number of bus stations	32 (including master)
Dummy load	Not required



MODBUS® is a registered trademark of the Schneider Automation Inc.

System response

Accuracy class	0.2 resp. 0.4 at applications with phase-shift
Duration of the measurement cycle	Approx. 0.5 to 1.2 s at 50 Hz, depending on measured variable and programming
Response time	1 … 2 times the measurement cycle

Reference conditions

Ambient temperature	15...30℃
Pre-conditioning	30 min. acc. to DIN EN 60 688
Input variable	Rated useful range
Power supply	H =Hn + 1%
Active/reactive factor	cos ϕ=1 resp. sin ϕ = 1
Frequency	50 ... 60 Hz, 16 2/3 Hz
Waveform	Sinusoidal, form factor 1.1107
Output load	DC current output:
Miscellaneous	EN 60 688

Influencing quantities and permissible variations
Acc. to EN 60 688

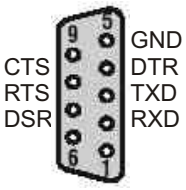
Power Supply →○

DC-, AC - power pack (DC and 50 ... 60 Hz)
Table 1: Rated voltages and tolerances

Rated voltage U_N	Tolerance
24 ... 60 V DC/AC	DC -15 ... + 33% AC ±10%
85 ... 230 V DC/AC	

Programming connector on transducer

Interface:	RS 232 C
DSUB socket:	9-pin



The interface is electrically insulated fromall other circuits

Ambient conditions

Variations due to ambient temperature:	± 0.1% / 10 K
Nominal range of use for temperature	0... 15...30...45℃ (usage group II)
Storage temperature	- 40 to + 85℃
Annual mean relative humidity	≤ 75%

Applicable standards and regulations

IEC 688 or DIN EN 60 688	Electrical measuring transducers for converting AC electrical variables into analogue and digital signals
IEC 1010 or EN 61 010	Safety regulations for electrical measuring, control and laboratory equipment
IEC 529 or EN 60 529	Protection types by case (code IP)
IEC 255-4 Part E5	High-frequency disturbance test (static relays only)
IEC 1000-4-2/-3/-4/-6	Electromagnetic compatibility for industrial-process measurement and control equipment
EN 55 011	Electromagnetic compatibility of data processing and telecommunication equipment Limits and measuring principles for radio interference and information equipment
IEC 68-2-1/-2/-3/-6/-27 or EN 60 068-2-1/-2/-3/ -6/-27	Ambient tests -1 Cold, -2 Dry heat, -3 Damp heat, -6 Vibration, -27 Shock
DIN 40 110	AC quantities
DIN 43 807	Terminal markings
IEC 1036	Alternating current static watt-hour meters for active energy (classes 1and 2)
DIN 43 864	Current interface for the transmission of impulses between impulse encoder counter and tarif meter
UL 94	Tests for flammability of plastic materials for parts in devices and appliances
parts in	devices and appliances

Safety

Protection class	II (protection isolated, EN 61 010-1)
Enclosure protection	IP 40, housing IP 20, terminals
Overvoltage category	III
Insulation test (versus earth)	Input voltage: AC 400 V Input Current: AC 400 V RS 485: DC 40 V Power supply: AC 400 V DC 230 V
Surge test :	5 kV; 1.2/50 ms; 0.5 Ws
Test voltages	50 Hz, 1 min. according to EN 61 010-1 5550 V, inputs versus all other circuits as well as outer surface 3250 V, input circuits versus each other 3700 V, power supply versus RS 485 and SCI as well as outer surface 490 V, RS 485 versus SCI as well as outer surface

Ambient tests

EN 60 068-2-6	Vibration
Acceleration frequency	+ 2 g 3 X 50 g 3 shocks each in 6 directions
Acceleration	Cold, dry heat, damp heat

Installation data

Housing	Housing T24 See Section "Dimensioned drawings"
:Housing material	Lexan 940 (polycarbonate), flammability class V-0 acc. to UL 94, self-extinguishing, non-dripping, free of halogen
Mounting	For snapping onto top-hat rail (35X15 mm or 35X7.5 mm) acc. to EN 50 022 or directly onto a wall or panel using the pull-out screw hole brackets
Orientation	Any
Weight	approx. 0.7 kg

Terminals

Type	Screw terminals with wire guards
Max. wire gauge:	$\leq$ 4.0 mm^2single wire or 2 X 2.5 mm^2fine wire

Table 2: RishDucer MXX, standard version

The versions of the transducer below programmed with the **basic** configuration are available ex stock. It is only necessary to quote the

Description / Basic programming		Marking	Order No.
1. Mechanical design:	Housing T24 for rail and wall mounting	M01 - 1	
2. Rated input frequency:	50 Hz	1	
3. **Power supply:**	**24… 60 V DC, AC**	**7**	
	85…230 V DC, AC	**8**	
4. Power supply connection:	External connection (standard)	1	
5. Test certificate:	None supplied	0	
6. Configuration:	Programmed basic configuration	0	
See Table 4: “Ordering information”			
Basic configuration			
1. Application (system):	4-wire, 3-phase system, asymmetric load	A 44	
2. Input voltage:	Design value Ur = 400 V	U 21	
3. Input current:	Design value Ir = 5 A	V 2	
4. Primary rating:	Without specification of primary rating	W 0	
5. Energy meter 1:	Not used	EA 00	
6. Energy meter 2:	Not used	FA 00	
7. Energy meter 3:	Not used	GA 00	
8. Energy meter 4:	Not used	HA 00	
See Table 3: “Programming”			

Table 3: Programming

Description / Basic programming	Application		
	A11 … A16	A34	A24 / A44
(system) Single-phase AC	A11	——	——
3-wire, 3-phase symmetric load, phase-shift U: L1-L2, I: L1 *	A12	——	——
3-wire, 3-phase symmetric load	A13	——	——
4-wire, 3-phase symmetric load	A14	——	——
3-wire, 3-phase symmetric load, phase-shift U: L3-L1, I: L1 *	A15	——	——
3-wire, 3-phase symmetric load, phase-shift U: L2-L3, I: L1 *	A16	——	——
3-wire, 3-phase asymmetric load	——	A34	——
4-wire, 3-phase asymmetric load	——	——	A44
4-wire, 3-phase asymmetric load, open-Y	——	——	A24

Table 3: Programming

Description / Basic programming	Application		
	A11 … A16	A34	A24 / A44
Rated value Ur = 57.7 V	U01	——	——
Rated value Ur = 63.5 V	U02	——	——
Rated value Ur = 100 V	U03	——	——
Rated value Ur = 110 V	U04	——	——
Rated value Ur = 120 V	U05	——	——
Rated value Ur = 230 V	U06	——	——
Rated value Ur [V]	U91	——	——
Rated value Ur = 100 V	U21	U21	U21
Rated value Ur = 110 V	U22	U22	U22
Rated value Ur = 115 V	U23	U23	U23
Rated value Ur = 120 V	U24	U24	U24
Rated value Ur = 400 V	U25	U25	U25
Rated value Ur = 500 V	U26	U26	U26
Rated value Ur [V] Lines U01 to U06: Only for single phase AC current or 4-wire, 3-phase symmetric load Line U91: Ur [V] 57 to 400 Line U93: Ur [V] > 100 to 693	U93	U93	U93
Rated value Ir = 1 A V1	V1	V1	
Rated value Ir = 2 A V2	V2	V2	
Rated value Ir = 5 A V3	V3	V3	
Rated value Ir > 1 to 6 [A]	V9	V9	V9
Without specification of primary rating	W0	W0	W0
VT = kV CT = A Line W9: Specify transformer ratio primary, e.g. 33 kV, 1000 A The secondary ratings must correspond to the rated input voltage and current specified for feature 2, respectively 3.	W9	W9	W9
Not used	EA00	EA00	EA00
I System [Ah]	EA50	——	——
I1 L1 [Ah]	——	EA51	EA51
I2 L2 [Ah]	——	EA52	EA52
I3 L3 [Ah]	——	EA53	EA53
S System [VAh]	EA54	EA54	EA54
S1 L1 [VAh]	——	——	EA55
S2 L2 [VAh]	——	——	EA56
S3 L3 [VAh]	——	——	EA57
P System (incoming) [Wh]	EA58	EA58	EA58
P1 L1 (incoming) [Wh]	——	——	EA59
P2 L2 (incoming) [Wh]	——	——	EA60
P3 L3 (incoming) [Wh]	——	——	Ea61

Continuation “5. Energy Meter 1” see next page!

Table 3: Programming

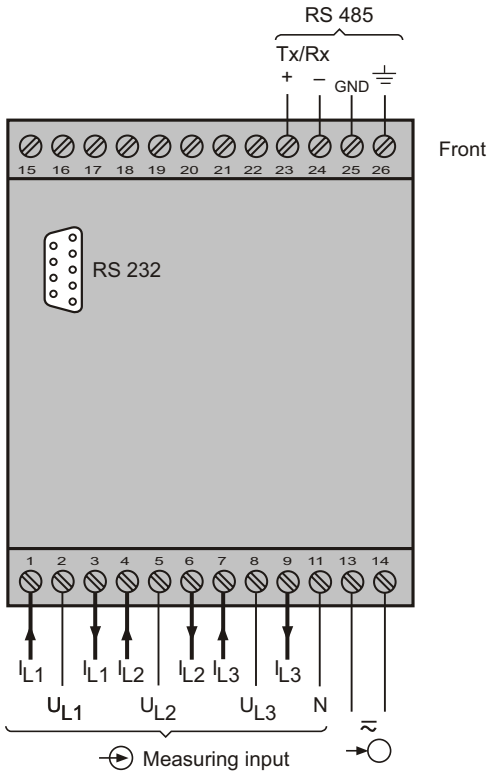
Description / Basic programming	Application		
	A11 … A16	A34	A24 / A44
Q System (inductive) [Varh]	EA62	EA62	EA62
Q1 L1 (inductive) [Varh]	——	——	EA63
Q2 L2 (inductive) [Varh]	——	——	EA64
Q3 L3 (inductive) [Varh]	——	——	EA65
P System (outgoing) [Wh]	EA66	EA66	EA66
P1 L1 (outgoing) [Wh]	——	——	EA67
P2 L2 (outgoing) [Wh]	——	——	EA68
P3 L3 (outgoing) [Wh]	——	——	Ea69
Q System (capacitive) [Varh]	EA70	EA70	EA70
Q1 L1 (capacitive) [Varh]	——	——	EA71
Q2 L2 (capacitive) [Varh]	——	——	EA72
Q3 L3 (capacitive) [Varh]	——	——	EA73
Same as energy meter 1, but markings start with a capital F	FA ..	FA ..	FA ..
Same as energy meter 1, but markings start with a capital G	GA ..	GA ..	GA ..
Same as energy meter 1, but markings start with a capital H	HA ..	HA ..	HA ..

Electrical Connections

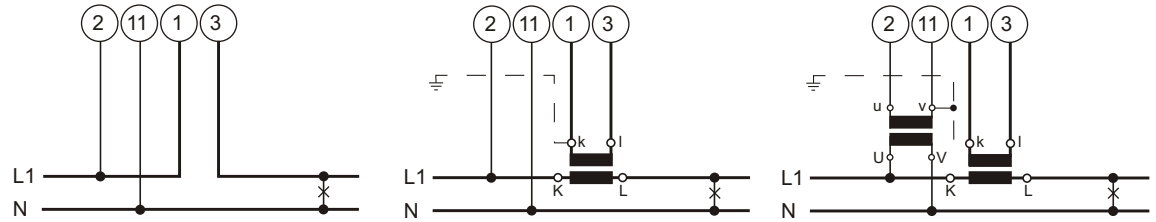
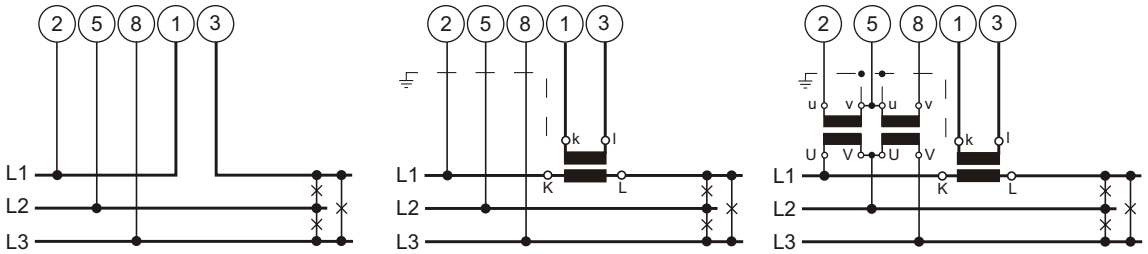
Function			Connect.
Measuring input	AC current	IL1	1 / 3
		IL2	4 / 6
		IL3	7 / 9
	AC voltage	UL1	2
		UL2	5
		UL3	8
		N	11
RS 485 (MODBUS)		Tx + / Rx +	23
		Tx – / Rx –	24
		GND	25
		⏚	26
Power supply	AC	~	13
		~	14
	DC	+	13
		–	14

If power supply is taken from the measured voltage internal connections are as follows:

Application (system)	Internal connection Terminal / System
Single-phase AC current	2 / 11 (L1 – N)
4-wire 3-phase symmetric load	2 / 11 (L1 – N)
All other (apart from A15 / A16 / A24)	2 / 5 (L1 – L2)



Electrical Connections

<table>
<tr><td></td><td colspan="3">Measuring input</td></tr>
<tr><td>System / application</td><td colspan="3">Terminals</td></tr>
<tr><td>Single-phase
AC system</td><td colspan="3"> 
</td></tr>
<tr><td>3-wire
3-phase
symmetric
load
I: L1</td><td colspan="3"> 

Connect the voltage according to the following table for current measurement in L2 or L3:
<table><tr><td>Current transf.</td><td colspan="2">Terminals</td><td>2</td><td>5</td><td>8</td></tr><tr><td>L2</td><td>1</td><td>3</td><td>L2</td><td>L3</td><td>L1</td></tr><tr><td>L3</td><td>1</td><td>3</td><td>L3</td><td>L1</td><td>L2</td></tr></table></td></tr>
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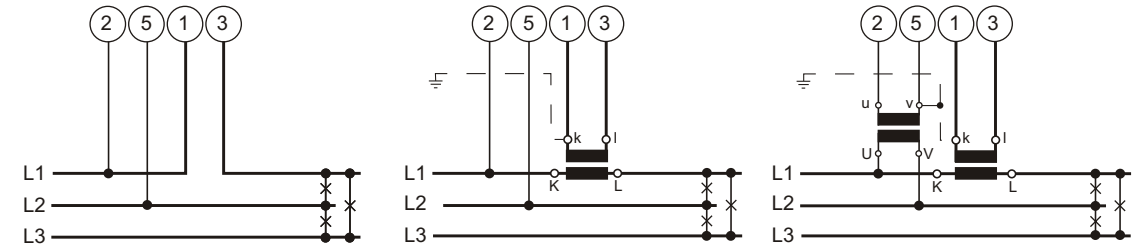
symmetric
load
Phase shift
U: L1 – L2
I: L1</td><td colspan="3"> 

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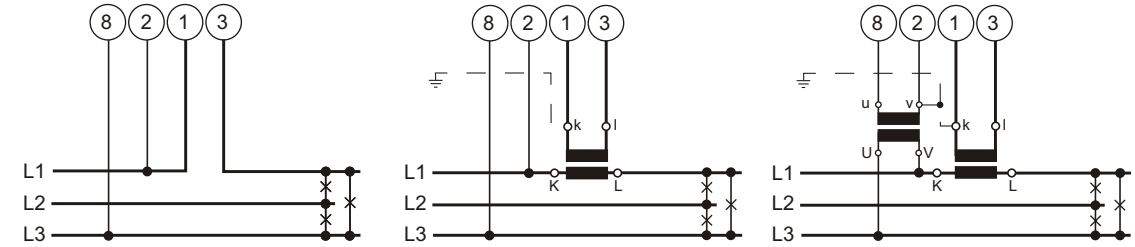
<tr><td>3-wire
3-phase
symmetric
load
Phase shift
U: L3 – L1
I: L1</td><td colspan="3"> 

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</table>

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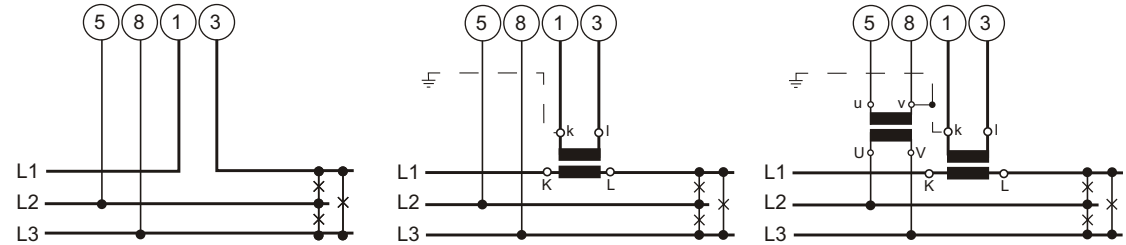
3-phase
symmetric
load
Phase-shift
U: L2 – L3
I: L1</td><td>


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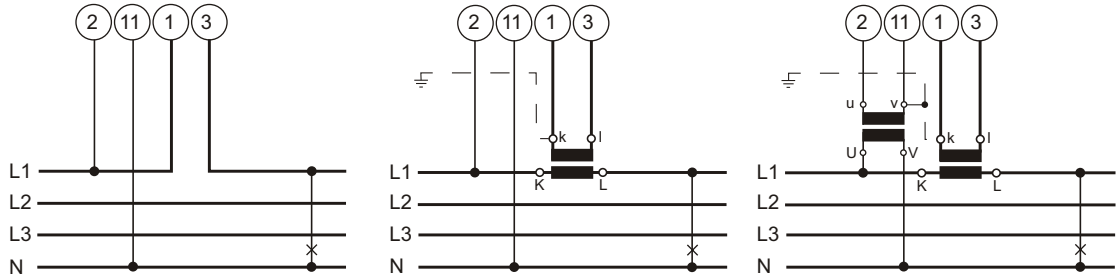
<tr><td>Current transf.</td><td colspan="2">Terminals</td><td>5</td><td>8</td></tr>
<tr><td>L2</td><td>1</td><td>3</td><td>L3</td><td>L1</td></tr>
<tr><td>L3</td><td>1</td><td>3</td><td>L1</td><td>L2</td></tr>
</table>
</td></tr>
<tr><td>4-wire
3-phase
symmetric
load
I: L1</td><td>


Connect the voltage according to the following table for current measurement in L2 or L3:
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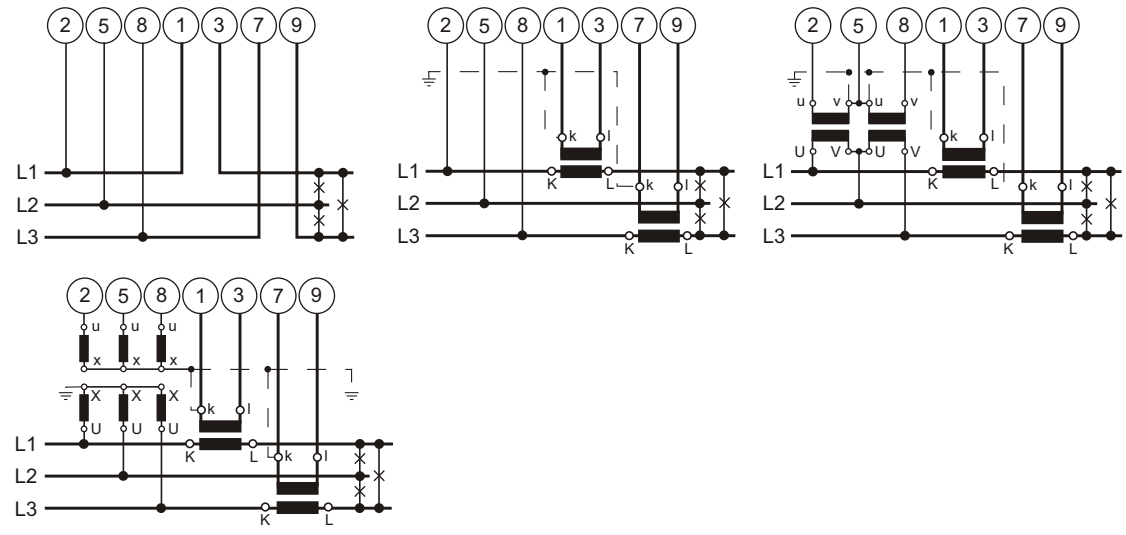
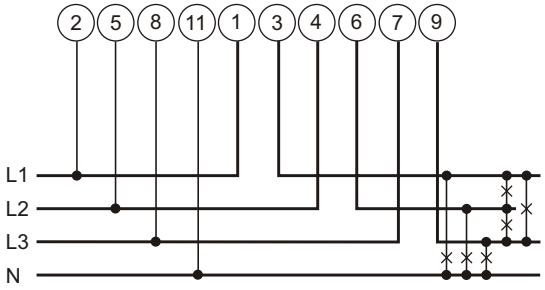
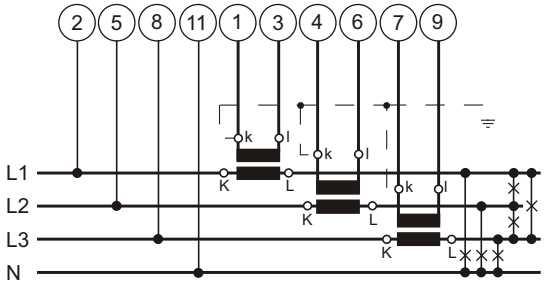
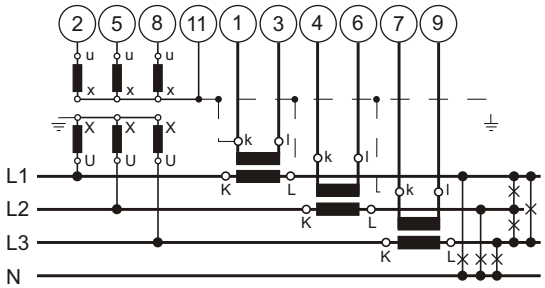
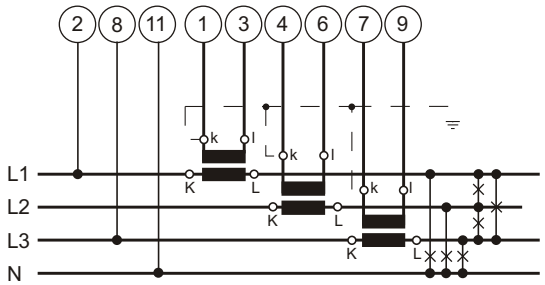
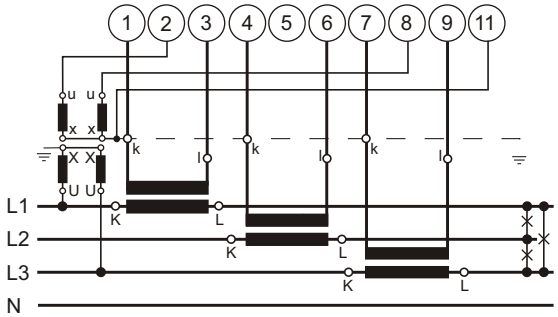
<tr><td>L2</td><td>1</td><td>3</td><td>L2</td><td>N</td></tr>
<tr><td>L3</td><td>1</td><td>3</td><td>L3</td><td>N</td></tr>
</table>
</td></tr>
<tr><td>3-wire
3-phase
asymmetric
load</td><td>


</td></tr>
</table>

Measuring input	
System / application	Terminals
4-wire 3-phase asymmetric load	   3 single-pole insulated voltage transformers in high-voltage system
4-wire 3-phase asymmetric load, Open Y connection	 Low-voltage system  2 single-pole insulated voltage transformers in high-voltage system

Relationship between PF, QF and LF

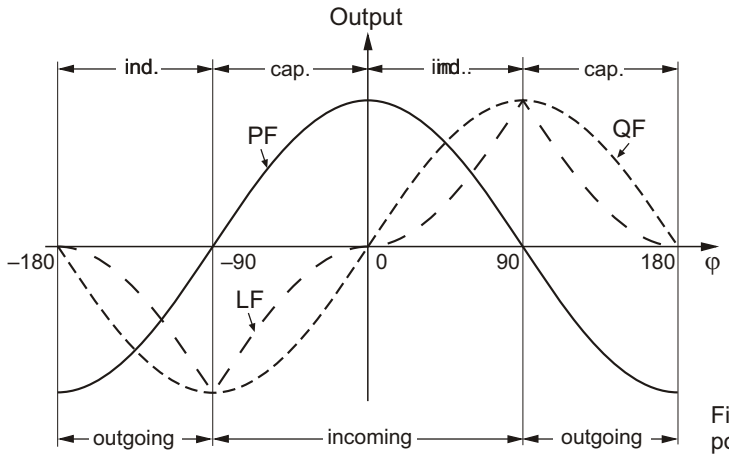


Fig. 3. Active power PF ——, reactive power QF ------, power factor LF – - – - –.

Dimensional Drawing

All Dimensions are in mm

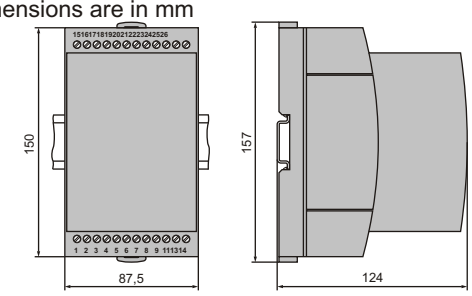


Fig. 5. RISH Ducer M01 in housing T24 clipped onto a top-hat rail (35 X 15 mm or 35 X 7.5 mm, acc. to EN 50 022).

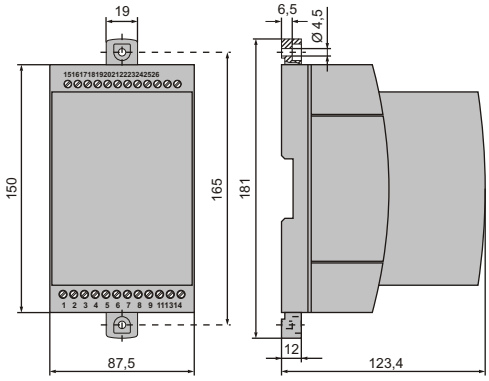


Fig. 6. RISH Ducer M01 in housing **T24**, screw hole mounting brackets pulled out.

Table 4: Accessories and spare parts

Description
Programming cable
Configuration software Ducer M01 for RISH Ducer M24, M40, M42, RISH Ducer , M00 and M01 Windows 3.1x, 95, 98, on CD
Operating Instructions in English

Standard accessories

1 Operating Instructions for ***RISH*** Ducer M 01 in English

1 Interface definition ***RISH*** Ducer M01: English

Ordering Information (Table 5)

DESCRIPTION	MARKING
1. Mechanical design	
Housing T24 for rail and wall mounting 01 - 1	M
2. Rated input frequency	
1) 50 Hz (60 Hz possible without additional error; 16 2/3 Hz, additional error 1.25)	1
2) 60 Hz (50 Hz possible without additional error; 16 2/3 Hz, additional error 1.25)	2
3) 16 2/3 Hz (not re-programming by user, 50/60 Hz possible, but with additional error 1.25)	3
3. Power supply	
7) Nominal range 24 … 60 V DC, AC	7
8) Nominal range 85 … 230 V DC, AC	8
4. Power supply connection	
1) External (standard)	1
2) Internal from measuring input	2
Line 2: Not available for rated frequency 16 2/3 Hz and applications A15 / A16 / A24 (see Table 4) Caution: The power supply voltage must agree with the input voltage (Table 4)!	
5. Test certificate	
0) None supplied	0
E) With test certificate in English	E
6. Configuration	
0) Basic configuration, programmed	0
9) Programmed acc. to specification	9
Line 0: Not available if the power supply is taken from the measuring input Line 9: **All the programming data must be entered on Form W 2408e and the form must be included with the order.**	

RISHABH

All specifications are subject to change without notice

Measure Control Record Analyze Optimize

RISHABH INSTRUMENTS LIMITED

Domestic (India): +91 253 2202099 | marketing@rishabh.co.in

International: +91 253 2202004/06/08/99 | global@rishabh.co.in

www.rishabh.co.in