M20 - 2 analogue outputs, M30 - 3 analogue outputs
Programmable multi-transducer

for the measurement of electrical variables in heavy current power systems

Application

The RISH Ducer M20, M30 series of multi - transducers (Fig. 1) simultaneously measure several variables of an electric power system and process them to produce 2 resp. 2 or 3 Analog outputs are available or power metering. For two of the limit outputs up to three misbrands can be logically combined.

The multi-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.

The usual modes of connection, the types of measured variables, their ratings. the transfer characteristic for each output etc. are the main parameters that have to be programmed.

Ancillary functions include a power system check, provision for displaying the measured variably on a PC monitor, the simulation of the outputs for test purposes and a facility for printing nameplates.

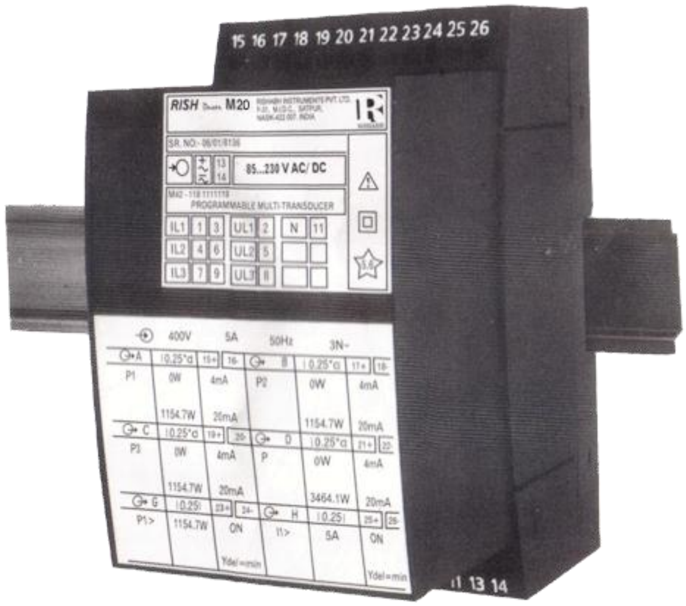


Fig.1.the universal basic version
RISHDucer M20, M30 in housing T24 ,clipped onto a top-hat rail.

Features / Benefits

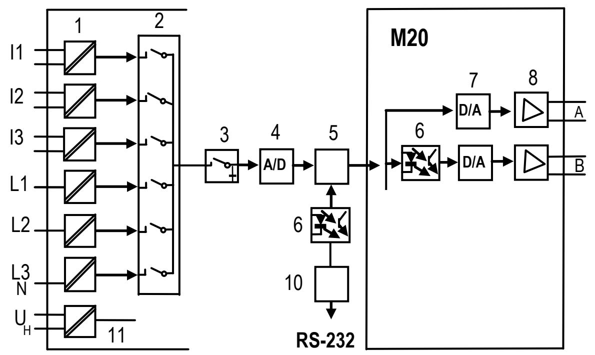
- Simultaneous measurement of several variables of a heavy-current power system / full supervision of an asymmetrically loaded four-wire power system ,rated current 1 to 6 A, rated voltage 57 to 400V (phase-to-neutral) or 100 to 693V (phase - to - phase)

Measured variables	Output	Types
Current ,Voltage (rms) , active/reactive/apparent power cos φ , sin φ, power factor RMS value of the current with wire setting range (bimetal measuring function)	2 analog Or 3 analog	M20 M30
Slave pointer function for the measurement of the RMS value IB Frequency		
Average value of the currents with sign of the active power (power system only)		

- For all heavy-current power system variables
- 2 or 3 outputs
- Input voltage up to 693V (phase-to-phase)
- Universal analogue outputs (programmable)
- High accuracy: U/I 0.2% Frequency 0.15 % and P 0.25 % (under reference conditions)

*Contact to factory for complete details

- Windows software with password protection for programming. data analysis, power system status simulation, acquisition of meter data and making settings
- AC/DC power supply/universal
- Provision for either snapping the transducer onto top-hat rails or securing it with screws to a wall or panel



1 = Input transformer
2 = Multiplexer
3 = Latching stage
4 = A/D converter
5 = Microprocessor
6 = Electrical insulation
7 = D/A converter
8 = Output amplifier/latching stage
9 = Digital output (open-collector)
10 = Programming interface RS-232
11 = Power supply

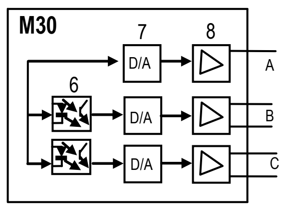


Fig.2.Block diagram.
A,B,C,D = analogue outputs; E,F,G,H = digital outputs

Symbols

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
U12	Phase-to-phase voltage L1 - L2
U23	Phase-to-phase voltage L2 - L3
U31	Phase-to-phase voltage L3 - L1
U1N	Phase-to-phase voltage L1 - N
U2N	Phase-to-phase voltage L2 - N
U3N	Phase-to-phase 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 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 $S=\sqrt{I_1^2+I_2^2+I_3^2}\cdot\sqrt{U_1^2+U_2^2+U_3^2}$
S1	Apparent power phase 1 (phase-to-neutral L1 - N)
S2	Apparent power phase 2 (phase-to-neutral L2 - N)
S3	Apparent power phase 2 (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 phase 1 P1/S1
PF2	Active power factor phase 2 P2/S2
PF3	Active power factor phase 3 P3/S3
QF	Reactive power factor sin φ = Q/S
QF1	Reactive power factor phase 1 Q/S
QF2	Reactive power factor phase 2 Q2/S2
QF3	Reactive power factor phase 3 Q3/S3
LF	Power factor of the system LF = sgn Q • (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|)
C	Factor for the intrinsic error
R	Output load
Rn	Rated burden
H	Power supply
Hn	Rated value of the power supply
CT	c.t. ratio
VT	v.t. ratio

Applicable standards and regulations

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
EN 60529	Protection types by case (code IP)
IEC 255-4 Part E5	High-frequency interference test (solid-state relays only)
IEC 1000-4-2,3,4,6	Electromagnetic compatibility for industrial process measurement and control equipment
VDI/VDE 3540 Page 2	Reliability of measuring and control equipment (classification of climates)
DIN 40 110	AC quantities
DIN 43 807	Terminal markings
IEC 68/2-6	Basic environmental testing procedures, vibration, sinusoidal
IEC 1036	Solid state AC watt hour meters for active power (Classes 1 and 2)
DIN 43864	Current interface for the transmission of impulses between impulse encoder counter and tariff meter
UL 94	Tests for flammability of plastic materials for parts in devices and appliances

Technical data

Inputs ⊖→

Input variables:	see Table 2 and 3
Measuring ranges:	see Table 2 and 3
Waveform:	Sinusoidal
Rated frequency:	50…60 Hz; 16 2/3 Hz
Consumption:	Voltage circuit: ≤ U² / 400 kW Condition external power supply Current circuit: 0.3 VA • I/5 A

Continuous thermal ratings of inputs

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

Short-time thermal rating of inputs

Input variable	Number of inputs	Duration of overload	Interval 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 S
Three-phase system 1040 V H intern:1.5 Ur	10	10 S	10 S

Analogue outputs ⊖→
For the outputs A,B,C

Output variable Y	Impressed DC current	Impressed DC voltage
Full scale Y2	see" Ordering Information"	see" Ordering Information"
Limits of output signal for input overload and/or R = 0	1.25 • Y2	40 mA
R→∞	30V	1.25 Y2
Rated useful range of output load	$0 \leq \frac{7.5\ V}{Y2} \leq \frac{15\ V}{Y2}$	$\frac{Y2}{2mA} \leq \frac{Y2}{1mA} \leq \infty$
AC component of output signal (peak-to-peak)	≤ 0.005 Y2	≤ 0.005 Y2

The outputs A,B,C may be either short or open- circuited.
They are electrically insulated from each other and from all other circuits (floating)

All the full-scale output values can be reduced subsequently using the programming software, but a supplementary error results.

The hardware full-scale settings for the analogue outputs may also be changed subsequently. Conversion of a current to a voltage output or vice is also possible This necessitates changing resistors on the output board. The full-scale values of the current and voltage outputs are set by varying the effective value of two parallel resistors (better resolution). The values of the resistors are selected to achieve the minimum absolute error. Calibration with the programming software is always necessary following conversion of the outputs. Refer to the Operating instructions. caution: The warranty is void if the device is tampered with

Reference conditions

Ambient temperature:	+ 23 °C ± 1K
Pre-conditioning:	30 min. acc. to DIN EN 60 688 Section 4.3, Table 2
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: $R_n = \frac{7.5\ V}{Y2} \pm 1\%$ DC voltage output: $R_n = \frac{Y2}{1mA} \pm 1\%$
Miscellaneous:	DIN EN 60 688

System response

Accuracy class: (the reference value is the full-scale value Y2)

Measured variables	Condition	Accuracy class*
System: Active, reactive and apparent power	0.5 ≤ X2/Sr ≤ 1.5 0.3 ≤ X2/Sr < 0.5	0.25 c 0.5 c
Phase: Active, reactive and apparent power	0.167 ≤ X2/Sr ≤ 0.5 0.1 ≤ X 2/Sr < 0.167	0.25 c 0.5 c
Power factor active, reactive and apparent power	0.5Sr ≤ S ≤ 1.5 Sr (X2 - X0) = 2 0.5Sr ≤ S≤1.5 Sr 1 ≤ (X2 - X0) < 2 0.5 Sr ≤ S ≤ 1.5 Sr 0.5 ≤ (X2 - X0) < 1 0.1Sr ≤ S < 0.5 Sr (X2 - X0) = 2 0.1Sr ≤ S < 0.5 Sr 1 ≤ (X2 - X0) < 2 0.1Sr ≤ S < 0.5 Sr 0.5 ≤ (X2 - X0) < 1	0.25 c 0.5 c 1.0 c 0.5 c 1.0 c 2.0 c
AC voltage	0.1 Ur ≤ U ≤ 1.2 Ur	0.2 c
AC current/ current averages	0.1 Ir ≤ I ≤ 1.5 Ir	0.2 c
System frequency	0.1 Ur ≤ U ≤ 1.2 Ur resp. 0.1 Ir ≤ I ≤ 1.5 Ir	0.15 + 0.03 c (f_N = 50…60 Hz) 0.15 + 0.1c (f_N= 16 2/3 Hz
Pulse	acc. to IEC 1036 0.1 Ir ≤ I ≤ 1.5 Ir	1.0

*Basic accuracy 0.5 c for applications with phase-shift

Duration of the measurement cycle:	Approx.0.25 to 0.5 s at 50 Hz depending on measured variable and programming

Response time: 1….2 times the measurement cycle
Factor c (the highest value applies):

Linear characteristic:

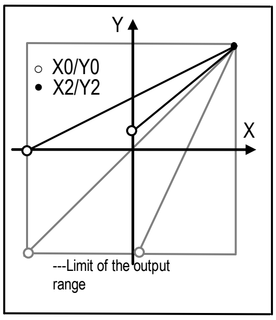
$$C = \frac{1 - \frac{Y0}{Y2}}{1 - \frac{X0}{X2}} \text{ or } C = 1$$

Bent characteristic:
X0 ≤ X ≤ X1

$$C = \frac{Y1 - Y0}{X1 - X0} \bullet \frac{X2}{Y2} \text{ or } C = 1$$

X1 < X ≤ X2

$$C = \frac{1 - \frac{Y1}{Y2}}{1 - \frac{X1}{X2}} \text{ or } C = 1$$



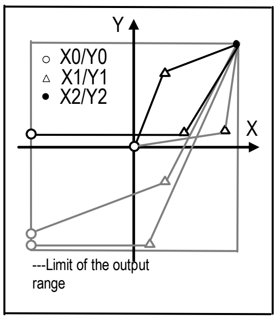


Fig.3 Examples of settings with linear characteristic

Fig. 4 Examples of settings with bent with bent characteristic.

Influencing quantities and permissible variations

Acc. to DIN IEC 688

Safety

Protection class:	II	
Enclosure protection:	IP 40,housing IP 20,terminals	
Overvoltage category:	III	
Insulation test(versus earth):	Input voltage:	AC 400V
	Input current:	AC 400V
	Output:	DC 40V
	Power supply:	AC 400V DC 230V
Surge test:	5 kV; 1.2/50 us; 0.5 Ws	
Test voltages:	50 Hz,1 Min. according to DIN 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 outputs and SCI as well as outer surface 490 V outputs and SCI versus each other and versus outer surface	

Power supply

AC voltage: 100,110,230,400,500,or 693 V ±10%,45 to 65 Hz
Power consumption approx. 10 VA

AC/DC power pack (DC and 50… 60 Hz)

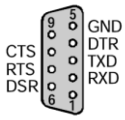
Table 1: Rated voltages and tolerances

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

Consumption: ≤ 9 W resp. ≤ 10 VA

Programming connector on transducer

Interface:	RS 232 C
DSUB socket:	9-pin



The interface is electrically insulated from all other circuits

Installation data

Housing:	Housing T24 See Section "Dimensioned drawings"
Housing material:	Lean 940 (Polycarbonate). Flammability class V-0 acc. to UL 94 self-extinguishing, non-dripping, free of halogen
Mounting:	For snapping onto top-hat rail (35 X 15 mm or 35 X 7.5 mm) acc. to EN 50 022 or directly onto a wall or panel using the pull-out screw hole brackets
Orientation:	Any
Weight:	With supply transformer approx. 1.1 kg With AC/DC power pack approx. 0.7 kg

Terminals

Type:	Screw terminals with wire guards
Max. wire gauge:	≤ 4.0 mm² single wire or 2 X 2.5 mm² fine wire

Vibration withstand

(tested according to DIN EN 60 068-2 -6)

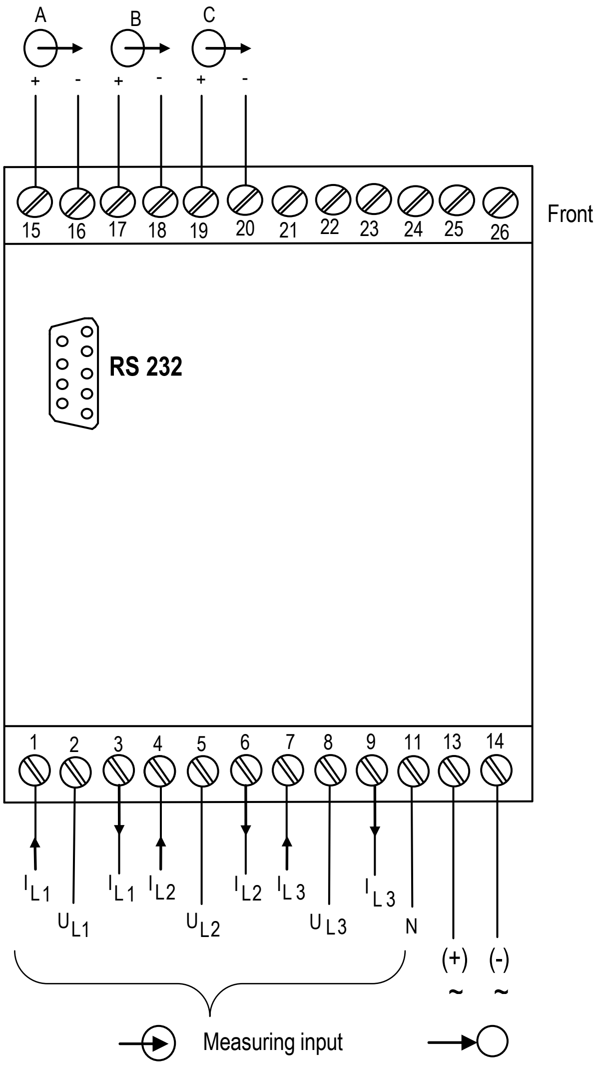
Acceleration:	± 2 g
Frequency range:	10..150..10 Hz, rate of frequency sweep: 1 octave/minute
Number of cycles:	10 in each of the three axes
Result:	No faults occurred, no loss of accuracy and no problems with the snap fastener

Ambient conditions

Climatic rating:	Climate class 3 acc. to VDI/VDE 3540
Variations due to ambient temperature:	± 0.1%/10 K
Nominal range of use for temperature:	0..15..30..45 °C (usage group II)
Storage temperature:	- 40 to + 85 °C
Annual mean relative humidity:	≤ 75%

Electrical connections

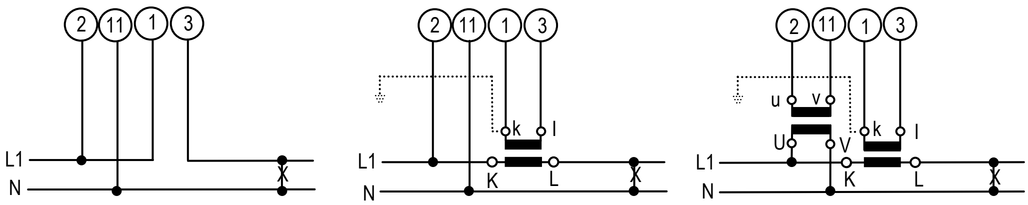
Function			Connection
Meas. Input	AC current	IL1	1/3
		IL2	4/6
		IL3	7/9
	AC voltage	UL1	2
		UL2	5
		UL3	8
		N	11
Outputs	Analogue	Digital	
	A	+	15
		-	16
	B	+	17
		-	18
	C	+	19
		-	20
			21
			22
			23
			24
			25
			26
Power supply	AC	~	13
		~	14
	DC	+	13
		-	14



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

Application (system)	Internal connection Terminal / System
Single phase AC current	2 / 11 (L1 - N)
4-wire 3-phase symmetric load	2 / 11 (L1 - 2)
All other*	2 / 5 (L1 - L2)

Measuring Input

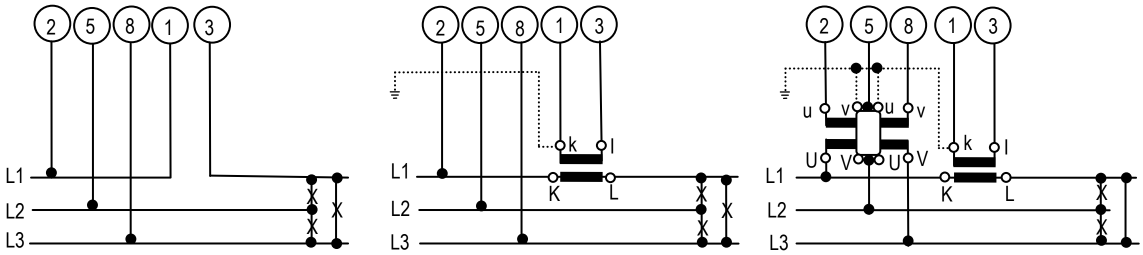
System/application	Terminals
Single-phase AC system	

*Contact to factory for complete details

Measuring Input

System/ application	Terminals

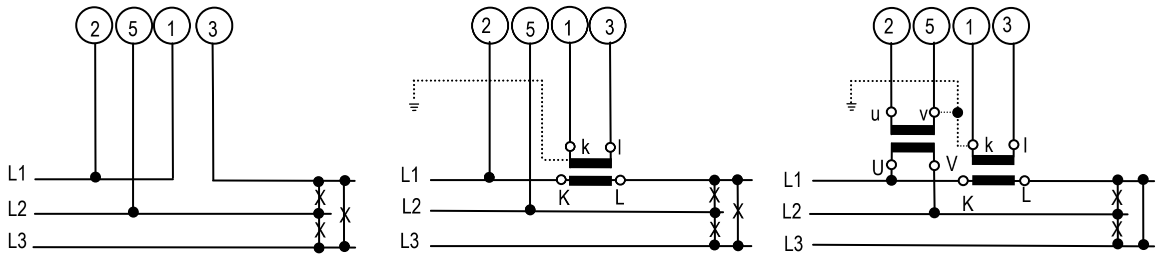
3-wire 3-phase symmetric load I:L1



Connect the voltage according to the following table for current measurement in L2 or L3:

Current transformer	Terminals		2	5	8
L2	1	3	L2	L3	L1
L3	1	3	L3	L1	L2

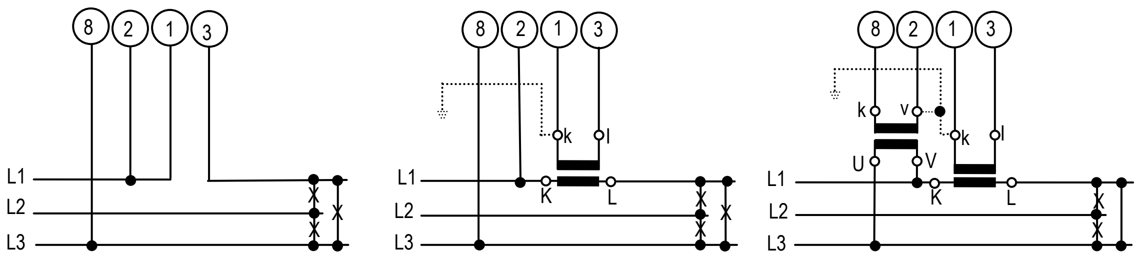
3-wire 3-phase symmetric load Phase-shift U:L1 - L2 I:L1



Connect the voltage according to the following table for current measurement in L2 or L3:

Current transformer	Terminals		2	5
L2	1	3	L2	L3
L3	1	3	L3	L1

3-wire 3-phase symmetric Load Phase-shift U:L3 - L1 I:L1



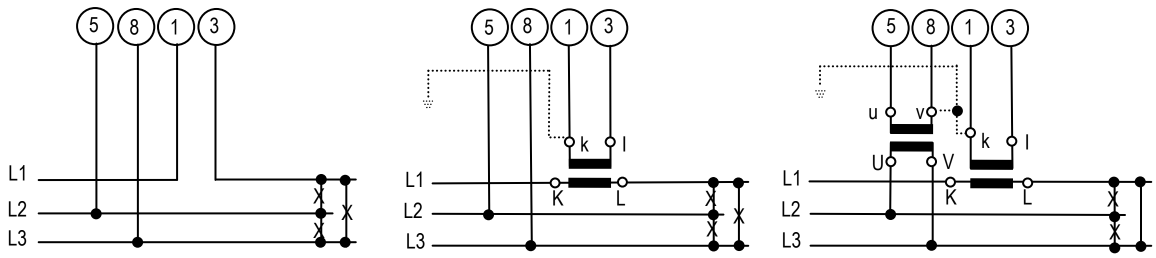
Connect the voltage according to the following table for current measurement in L2 or L3:

Current transformer	Terminals		8	2
L2	1	3	L1	L2
L3	1	3	L2	L3

Measuring Input

System/ application	Terminals

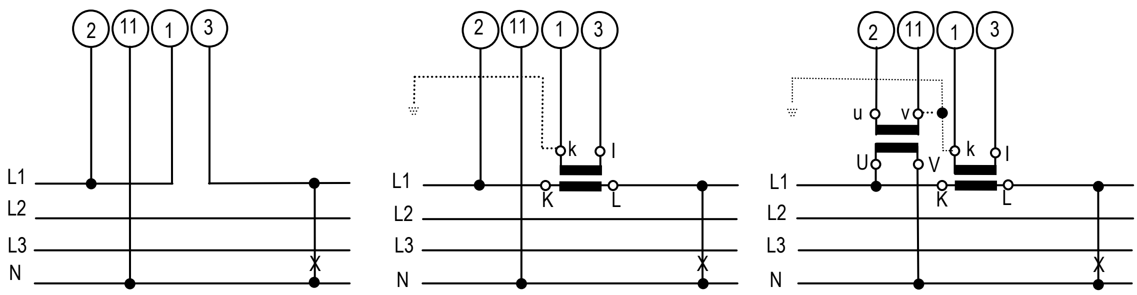
3-wire 3-phase symmetric load Phase-shift U:L2-L3 I:L1



Connect the voltage according to the following table for current measurement in L2 or L3:

Current transformer	Terminals		5	8
L2	1	3	L3	L1
L3	1	3	L1	L2

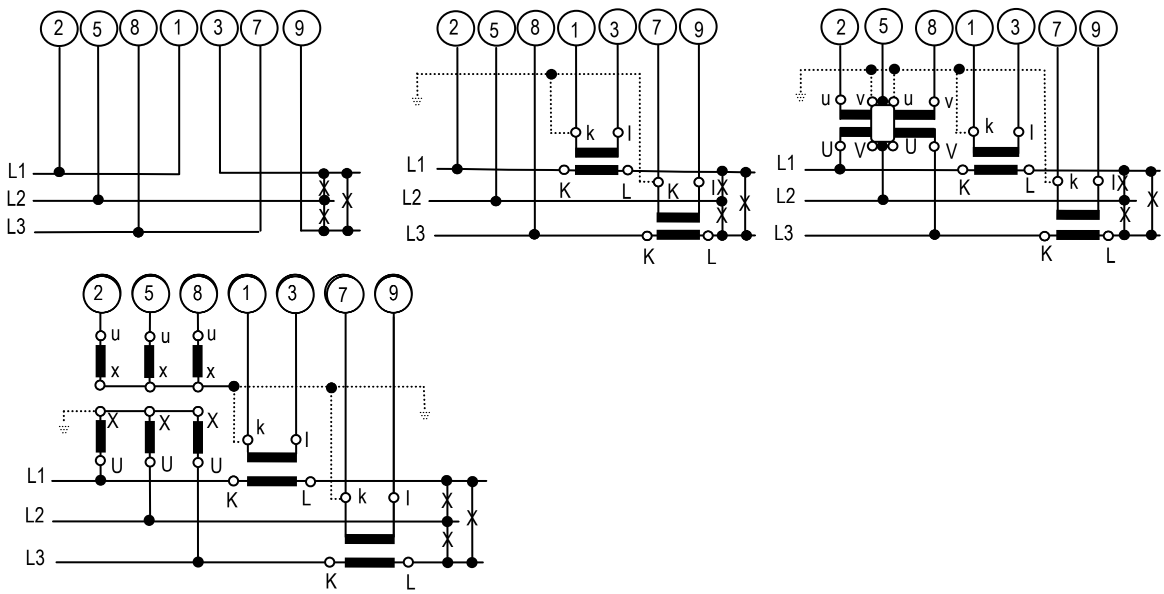
4-wire 3-phase symmetric load I:L1



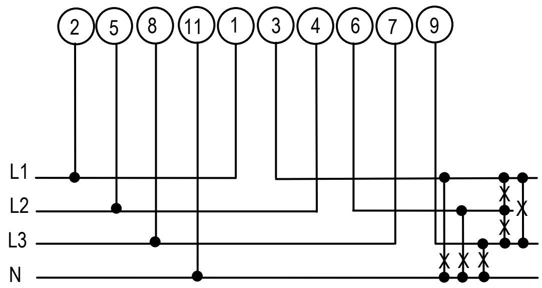
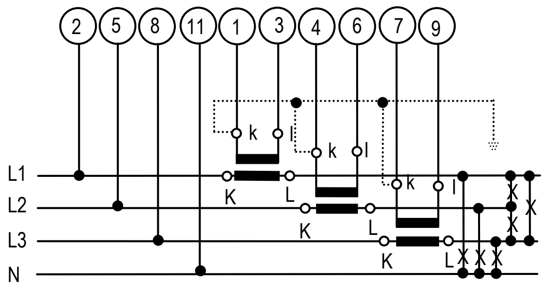
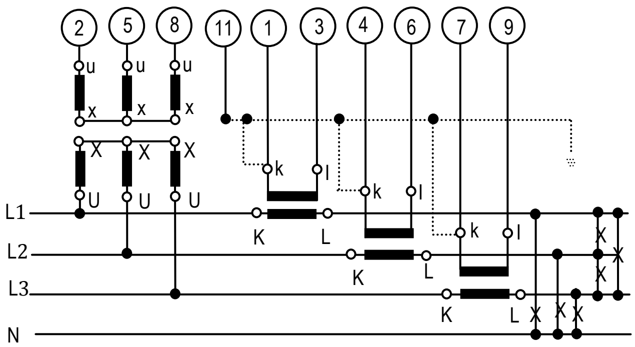
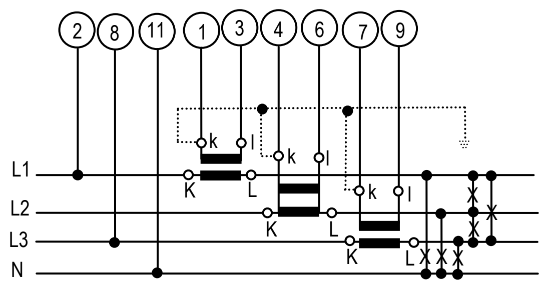
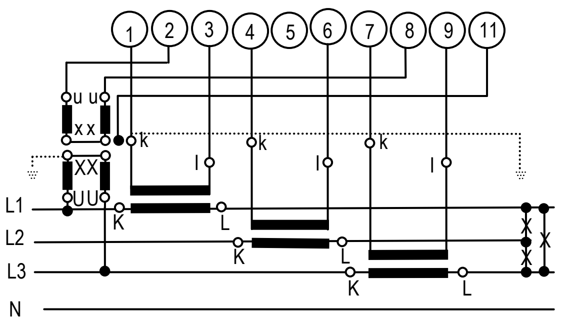
Connect the voltage according to the following table for current measurement in L2 or L3:

Current transformer	Terminals		2	11
L2	1	3	L2	N
L3	1	3	L3	N

3-wire 3-phase asymmetric load*

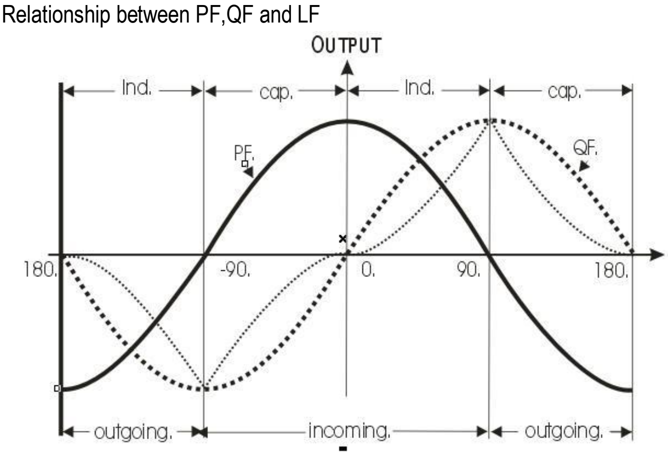


*Contact to factory for complete details

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

*Contact to factory for complete details

Relationship between PF,QF and LF



\ctive power PF------reactive power QF----power factor LF-------

Dimensioned drawings

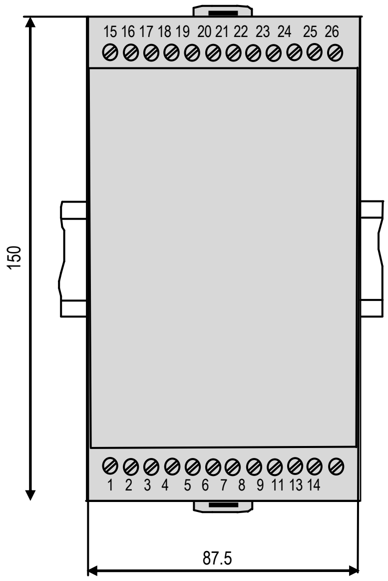
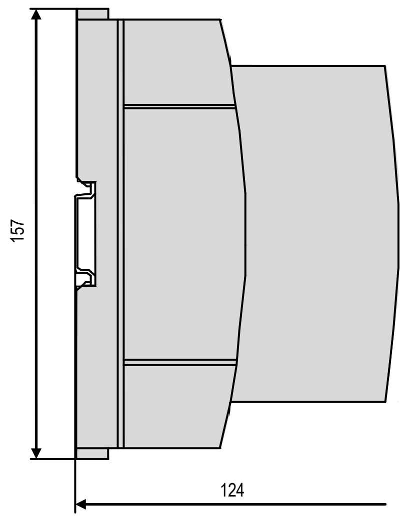


Fig.6 RISHDucer M20, M30 in housing
(35 15 mm or 35 7.5 mm, acc. to EN 50 022).



T24 clipped onto a top-hat rail

Table 4: Accessories

Description
Programming cable
PC software RISH Durer (in English on two 3 1/2* discs)
Operating Instructions RISH Ducer M20, M30. in English

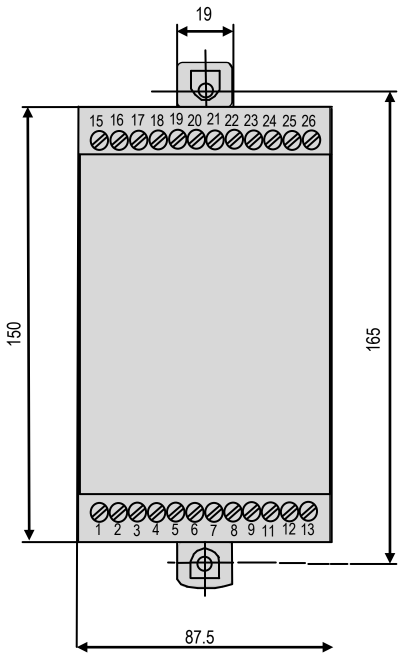
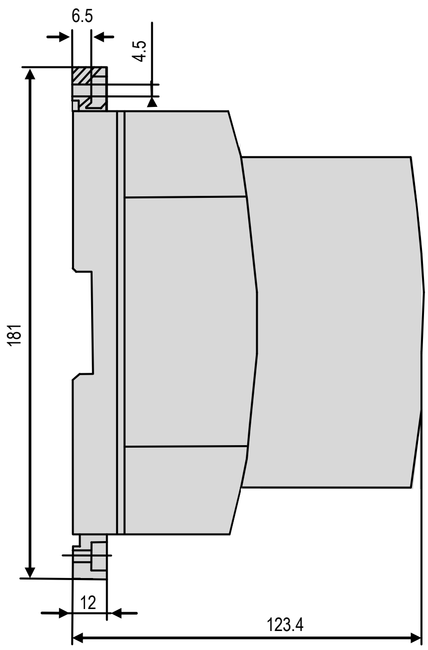


Fig.7.RISH Ducer M20, M30 in housing
Brackets pulled out.



T24, screw hole mounting