MAKING MODERN LIVING POSSIBLE

Instruction

VLT® FC Series Drives Leakage Current Monitor Module

VLT®
THE REAL DRIVE

1.1 VLT® Leakage Current Monitor Module

1.1.1 Intended Use

The AC/DC sensitive leakage current monitoring modules RCMB20-500-01 and RCMB35-500-01 are used for fault current monitoring in applications, where frequency converters are used, and direct and/or alternating fault currents are likely to occur.
Each module has to be installed and connected in the cable connection compartment in front of the mains input of the frequency converter.
Both variants of the modules provide an output signal 4...20 mA proportional to the high frequency leakage current.

1.1.2 Warning

Only intended for use to protect equipment and not for personal protection.

CE

Table 1.1 Approval

1.1.3 Device Features

- AC/DC sensitive measured value acquisition
- Frequency range 0…500 Hz
- Measuring current transformer, inside diameter 20 mm/35 mm
- Measuring range 500 mA
- Measuring time ≤ 180 ms
- Supply voltage 24 V DC
- Analogue output current 4…20 mA
- CT connection monitoring using cyclical test current
- LEDs: power On LED, alarm LED

1.1.4 Functional Description

After switching the supply voltage on, the multi-colour LED shows a green light and the leakage current monitoring module carries out a self test.
The leakage current monitoring module measures both AC and DC currents. The r.m.s. value is calculated by summing up the DC components included in the leakage current and the AC components that are below 500 Hz. A current signal of 4…20 mA proportional to the rms value is provided at the module output. The analogue value is updated at the latest every 20 ms.

Every two seconds, the leakage current monitoring module cyclically tests the connection to the measuring current transformer and the correct functioning of the AC and DC measurement. In addition, the supply voltage is monitored continuously. If a fault occurs, the multi-colour LED flashes red and the analogue DC output current is 20 mA.

1.1.5 LED Indication of Operation Status

LED continuously lights green = normal operating condition
LED flashes red = fault
Examples of possible faults:
connection fault, current transformer fault, module fault etc.

1

1.1.6 Installation and Connection

⚠WARNING

Ensure safe isolation from supply in the installation area. Observe the installation rules for live working. Failure to observe the rules may result in physical injury and damage to property.

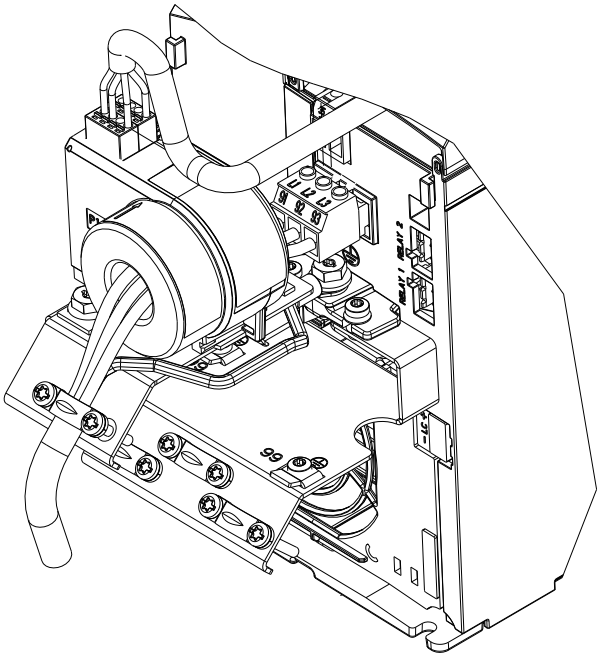

Illustration 1.1 Installation Example 1, Enclosure A2 and A3

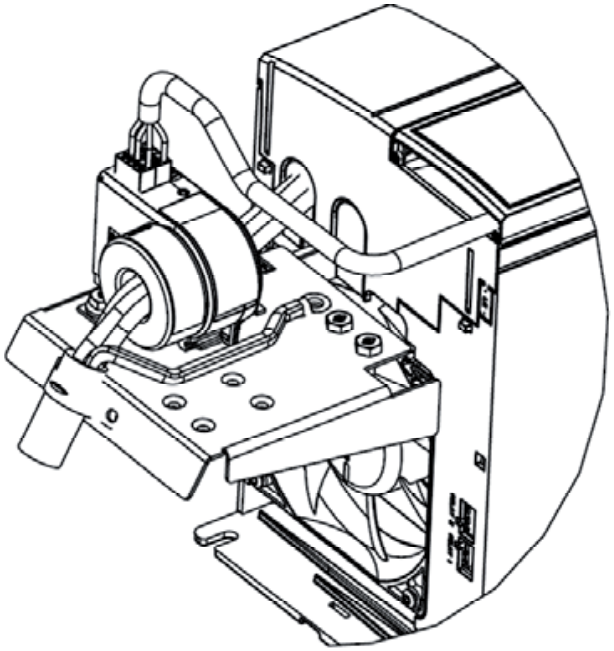

Illustration 1.2 Installation Example 2, Enclosure B3

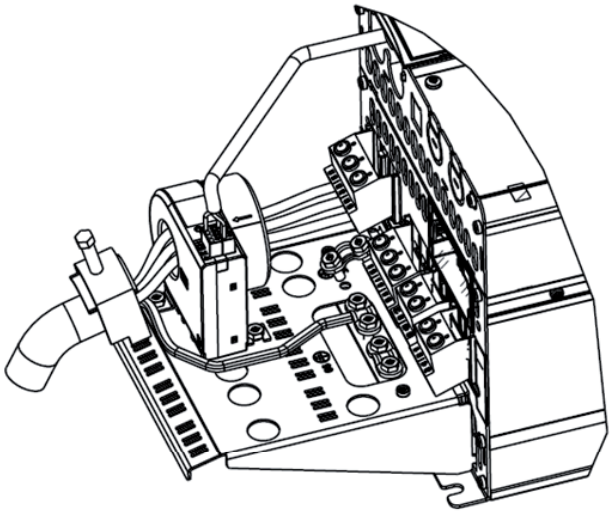

Illustration 1.3 Installation Example 3, Enclosure B4

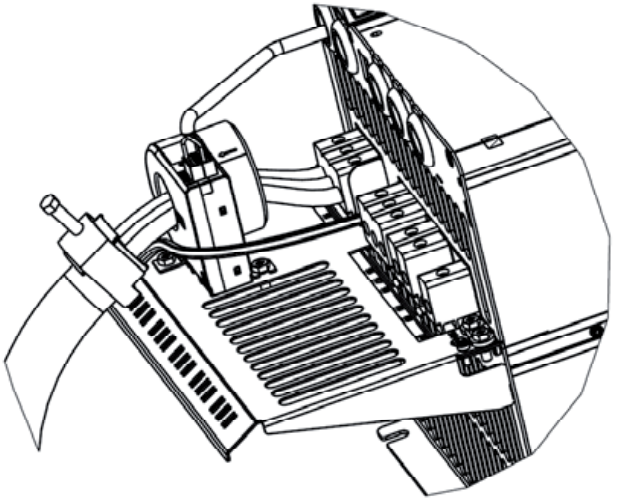

Illustration 1.4 Installation Example 4, Enclosure C3

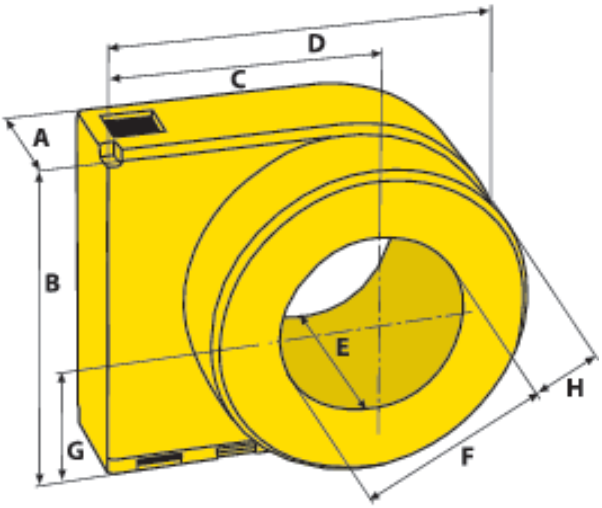

Illustration 1.5 Dimension Diagram

Type	A	B	C	D	E	F	G	H
Sensor RCMB20	30	56.3	50	76.4	48.5	ø 20	29.8	16.4
Sensor RCMB35	30	79.2	62	99.5	55	ø 35	41.7	20

Table 1.2 Legend to *Illustration 1.5*

All dimensions are in mm!

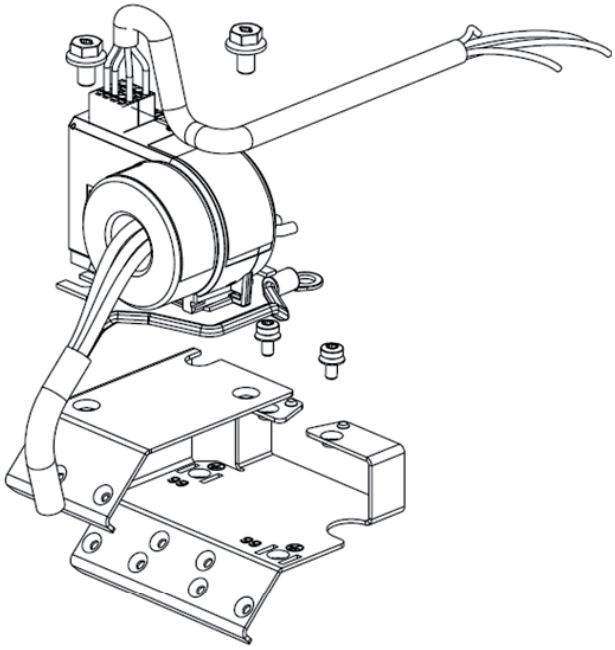

Illustration 1.6 Fitting the RCMB on the Mounting Plate

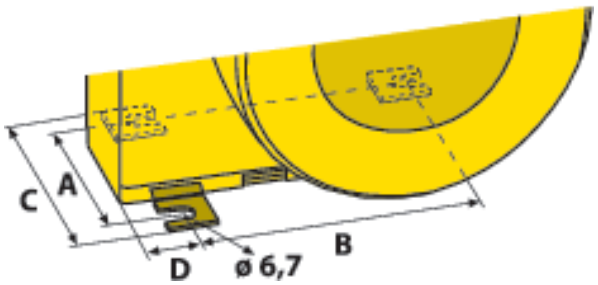

Illustration 1.7 Screw Mounting with Mounting Brackets (diagonal)

Type	A	B	C	D
Sensor RCMB20	47	29	63	20.35
Sensor RCMB35	47	48.5	63	12.85

Table 1.3 Legend to *Illustration 1.7*

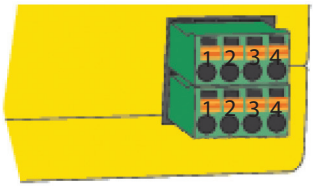

Illustration 1.8 Position of the Terminals

Control terminal connectors can be unplugged from the RCWB for ease of installation

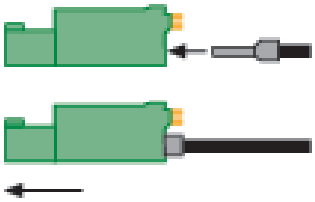

Illustration 1.9 Conductor Connection

1. Insert the bared control wire into the contact.
2. Ensure the contact is firmly established and not loose. Loose control wiring can be a source of equipment faults or not optimal operation.

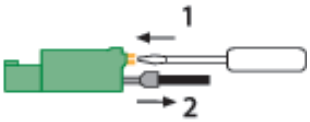

Illustration 1.10 Conductor Disconnection

Open the contact by inserting a small screwdriver into the slot above the contact, as shown in *Illustration 1.10*.

1

Illustration 1.11 Wiring the Plug-in Terminal XK1

Terminal (pin assignment)	Colour	Sensor
a (A1)	black	GND (U_S)
b (A2)	-	-
c (A3)	white	DC 4...20 mA
d (A4)	blue	GND (DC 4...20 mA)
e (B1)	red	+24 V (U_S)
f (B2)	-	-
g (B3)	-	-
h (B4)	-	-

Table 1.4 Legend to *Illustration 1.11*

Wiring diagram

Connect the leakage current monitoring module according to the wiring diagram. The output current in proportion to the leakage current I_A must be made available to the frequency converter.

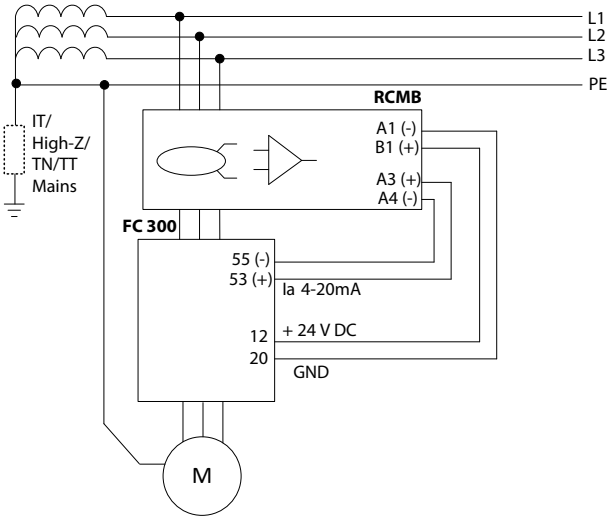

Illustration 1.12 Wiring Diagram

1.1.7 Commissioning

⚠CAUTION

Before commissioning, ensure that the RCM is properly connected. A minimum distance of 25 mm between the primary conductor and the control cable has to be permanently assured.

1.1.8 Application Example

The following example shows a typical application for the use of the VLT® Leakage Current Monitor Module. Follow the installation description as shown in this *Installation Guide*.

The following electrical connections are required: 24 V DC voltage supply of the frequency converter from terminal 12 (+24 V DC) and 20 (common) to terminals B1 and A1 of the monitoring device.

The analog signal (4-20 mA, A3(+) and A4(-)) of the monitoring device has to be connected to terminals 53 (+) and 55(-) to the frequency converter as well as the switch S201 on the control card selected to „I“. After the entire application is set to run mode with no faulty residual currents, the monitoring device's output is 4mA. An existing earth fault current leads to an increased output signal, proportional to the value of the fault current. Use the Smart Logic control functions to define a set point for achieving an alert on time. The example shown here uses the potential free relay 1 of the frequency converter, to report the status change to the upper level control system. A bus system can be used instead or simultaneously.

Functional description

If the application is operating in good conditions, the analog input of the frequency converter receives 4 mA out of the monitoring device. If a threshold of 4.2 mA is exceeded, a warning signal should be provided by the frequency converter's potential free relay 1. To dampen short time effects, the switching of the relay may be delayed by 1 second. With this approach, the existing of a very low level ground earth fault will be alerted. The threshold should be set close to the advised value, but can be specified by the user in its entirety.

NOTE

Danfoss can under no circumstance give an advice, how the signal shall be used, as each application has its specific requirements. This can vary from just visualizing to cut off. The required reaction has to be defined by the user.

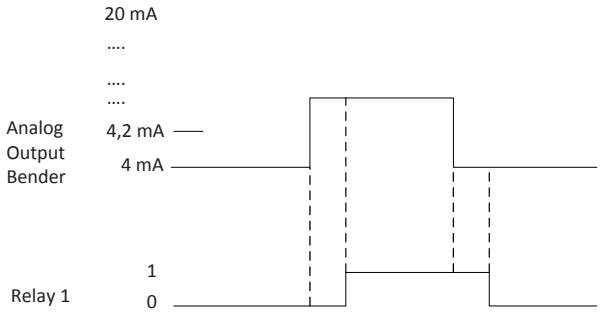

Illustration 1.13 Relay Output

Programming examples

The Smart Logic Control provides a comparator for the threshold, see *Table 1.5*.

ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Default value	Unit
1310.0	Comparator Operand	Analog input 53	Analog input 53	Analog input 53	Analog input 53	Disabled	
ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Default value	Unit
1311.0	Comparator Operator	>	>	>	>	≈ equal	
ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Default value	Unit
1312.0	Comparator Value	21	21	21	21	0.000	

Table 1.5 Comparator for Threshold

The comparator value is calculated by: 1312.0 = I_{limit} [mA * 5 // 21,000 for 4.2 mA]

The relay is linked to comparator 0, see *Table 1.6*

ID	Name	Setup 1
540.0	Function relay	Comparator 0

Table 1.6 Comparator 0

The dampening of 1 second leads to suppressing of short term effects, see *Table 1.7*

ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Default value	Unit
541.0	On Delay, Relay	1	0.01	0.01	0.01	0.01	s
ID	Name	Setup 1	Setup 2	Setup 3	Setup 4	Default value	Unit
542.0	Off Delay, Relay	1	0.01	0.01	0.01	0.01	s

Table 1.7 Dampening

1

1.1.9 Technical Data for Sensor RCMB20/RCMB35

Insulation coordination acc. to IEC 60664-1/IEC 60664-3	
Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	12 kV/2
Overvoltage category	CAT III
Protective separation (reinforced insulation) between primary conductor and the measurement electronics	
Voltage tests according to IEC 61010-1	6.88 kV

Supply voltage	
Supply voltage U_s	24 V DC
Operating range of U_s	20.4...28.8 V
Ripple U_s	≤ 1 %
Power consumption	≤ 2.5 VA

Measuring circuit	
Measuring current transformers RCMB20/RCMB35, inside diameter	20 mm/35 mm
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristics according to IEC 62020 and IEC/TR 60755	AC/DC sensitive, Type B
Rated frequency	0...500 Hz
Measuring range AC/DC	0...500 mA
Nominal current at 3 N AC	32 A/80 A
Relative uncertainty for DC (RCMB20/RCMB35)	± 5%
Relative uncertainty for 10...30 Hz	± 10 %
Relative uncertainty for 30...400 Hz	± 3.5%
Relative uncertainty for 400....500 Hz	± 20%
Resolution measuring circuit	2 mA
Test winding	yes

Time response	
Response delay t_{on}	0 s
Delay on release t_{off}	≤ 1 s
Operating time t_{ae} at $I_{\Delta n}$	≤ 180 ms
Response time t_{an}	= t_{ae} + t_{on}
Recovery time tb	≤ 300 ms

Displays	
LED constantly illuminated in green = operation indicator	flashes red = fault (output current > 20 mA

Outputs	
Current output	4...20 mA proportional to the leakage current
Current output, resolution	IΔn = 31.25 x (analogue output current - 4 mA)
Load	≤ 300 Ω

Environment/EMC	
EMC	IEC 60947-2
Operating temperature	-25...70 °C

Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	.3M4
Transport (IEC 60721-3-2)	2M3
Storage (IEC 60721-3-1)	
Chemical stresses acc. to IEC 60721	1M3
Stationary use (IEC 60721-3-3)	3C4

1.1.10 Connection

Primary conductor	
RCMB20	≤ 4 x 10 mm^2 or 3 x 16 mm^2
RCMB35	≤ 4 x 35 mm^2 or 3 x 50 mm^2

Connector XK1	
Connection type	pluggable spring-cage terminals

Connection properties	
Rigid	0,2...2,5 mm^2 (AWG 24...14)
Flexible without ferrules	0,2...2,5 mm^2 (AWG 24...14)
Flexible with ferrules	0,2...1,5 mm^2 (AWG 24...16)
Stripping length	10 mm
Opening force	50 N

General data	
Operating mode	continuous operation
Position	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
Screw mounting	M5 with mounting brackets
DIN rail mounting acc. to	IEC 60715

1.1.11 Standards

The leakage current monitoring module is designed in accordance with the DIN EN 62020 standard

Code number	Enclosure	Inside diameter	Supply voltage Us*
130B5645	A2-A3	20 mm	DC 20.4...28.8 V
130B5764	B3	20 mm	DC 20.4...28.8 V
130B5765	B4	35 mm	DC 20.4...28.8 V
130B6226	C3	35 mm	DC 20.4...28.8 V
130B5647	C4	35 mm	DC 20.4...28.8 V

Table 1.8 Ordering Details

** Absolute values of the voltage ranges*

www.danfoss.com/drives

130R0426 MI38U302 Rev. 2013-04-04