RVBS

Variable frequency drive for induction motors

Benefits

- **Easy to use**: limited configuration parameters required for shorter setup times
- **Time savings during installation**:Push-in connectors for faster and more reliable installation
- **Space saving solution**: designed on a very compact PCB to minimise space in the electrical panel'
- **Condition monitoring**: Modbus RTU interface for real time monitoring of motor variables.
- **Robust design**: Fanless design for increased reliability in harsh environment
- **Remote control:** RVBS can be controlled via voltage control or via serial communication for increased operational flexibility

Description

RVBS is a single phase input variable frequency drive (VFD) for induction motors. This VFD uses V/f control.

The RVBS comes in two versions 0.55 kW (2.7 Arms) and 0.75 kW (5 Arms). The open board design results in a very compact solution that can fit in electrical panels with limited space. Configuration of the RVBS can be done via a dedicated PC software, via an optional remote keypad or directly via the PLC via Modbus.

Specifications are stated at 40°C at a switching frequency of 6 kHz unless otherwise stated.

Applications

Compressors, conveyors and ventilation systems

Main functions

- Speed control, reversing of motors
- Control via serial communication or analog input

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References

▶ **Order code**

☞ **RVBS120 ☐ F**

Enter the code entering the corresponding option instead of ☐

Code	Option	Description	Notes
R	-		
V	-	Product family: Variable frequency drive for induction motors	
B	-		
S	-		
1	-	1-Phase supply	
20	-	Input voltage: 200 - 240 VAC (-15%, +10%), 50/60 Hz	
☐	055	Output power: 0.55 kW	
	075	Output power: 0.75 kW	
F	-	EMC filter	

▶ **Selection guide**

AC supply	Rated output power	Rated output current @ 40°C	Cooling method	Ordering code
1 - phase (230 VAC)	0.55 kW	2.7 Arms	Heatsink	RVBS120055F
	0.75 kW	5 Arms	Fan	RVBS120075F

▶ **Further reading**

Information	Where to find it

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▶ **CARLO GAVAZZI compatible components**

Purpose	Component name / code	Notes
Remote operator	RV-KEYPAD	

Structure
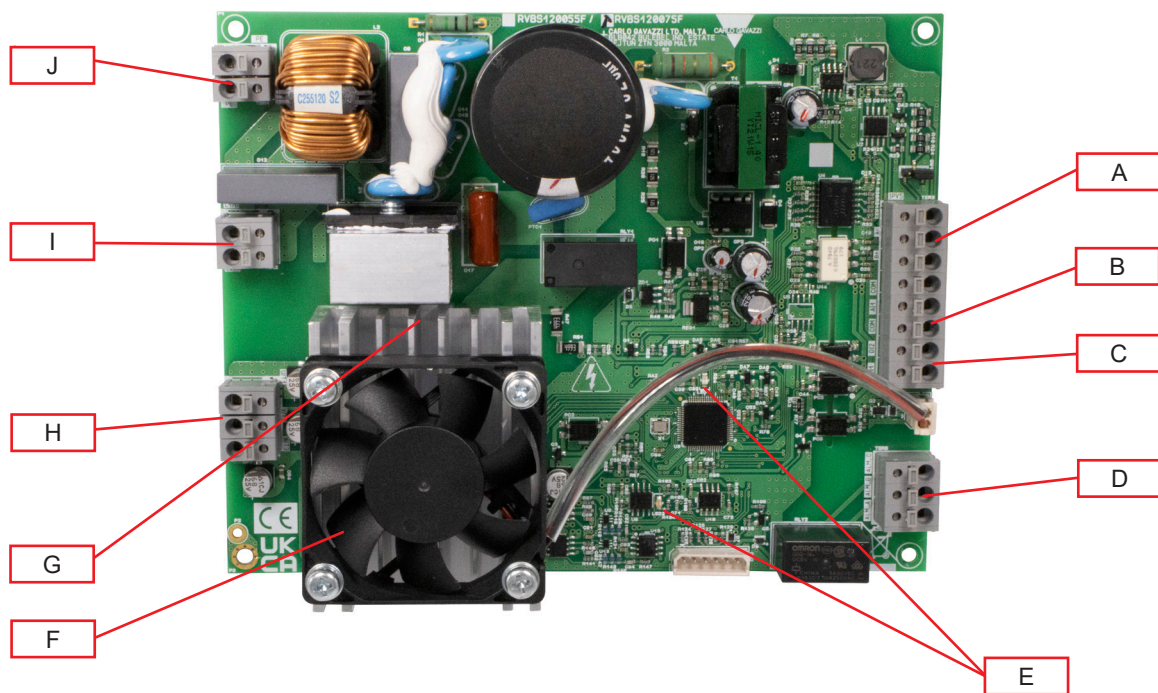
Element	Component	Function
A	Modbus connections	Configuration via Modbus RTU
B	Analog input	Control via Analog input
C	Digital input	Programmable digital inputs (q.ty: 2) for start, stop, reversing of motor and alarm reset. Topology: 24V NPN
D	Digital output	Relay output for fault indication
E	LED indicators	LED 1: Power ON (Green) LED 2: Fault indication (Red)
F	Fan	Cooling system
G	Heatsink	Thermal dissipation
H	Load connection	Load side connections (U, V, W)
I	Mains input connection	Connection for input voltage
J	PE connections	Protective earth connection

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Features

▶ General data

Control mode	Sensor-less vector control (SLV) for induction motors
Control method	Via digital inputs (NPN) or Modbus RTU
Frequency range	0 - 90 Hz
Configuration	Via serial port (Modbus RTU) or via remote keypad (RV-KEYPAD)
Protection grade	IP00
Cooling type	Heatsink, Fan
Weight	RVBS120055F: 0.43 kg
	RVBS120075F: 0.47 kg

▶ Power supply

	RVBS120055F	RVBS120075F
AC supply phase	1 - phase	
Input voltage	200 - 240 Vrms	
Input frequency	50 / 60 Hz (± 5%)	
Topology	Internally supplied (via mains)	
Integrated varistor	Yes	

▶ Environmental

Working temperature	-20 °C to +60 °C (-4 °F to + 140 °F)
Storage temperature	-20 °C to +60 °C (-4 °F to +140 °F)
Relative humidity	< 90% non-condensing @ 40 ºC
Installation category	2
Installation altitude	1000 m

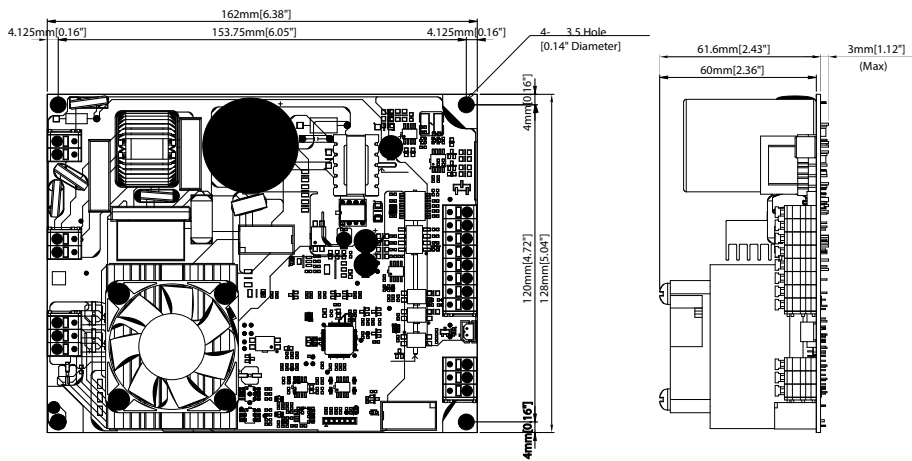### ▶ Compatibility and conformity

Standard compliance	**Low voltage directive**	IEC / EN 61800-5-1
	Electromagnetic compatibility	IEC / EN 61800-3 (Industrial environment)
Marks	CE UKCA	

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▶ **Dimensions**

Unit: mm [inches]

162mm[6.38"]
4.125mm[0.16"] 153.75mm[6.05"] 4.125mm[0.16"] 4- 3.5 Hole [0.14" Diameter]
4mm[0.16"]
120mm[4.72"] 128mm[5.04"]
4mm[0.16"]
51.6mm[2.03"] 3mm[1.12"]
50mm[1.97"] (Max)

RVBS120055F

162mm[6.38"]
4.125mm[0.16"] 153.75mm[6.05"] 4.125mm[0.16"] 4- 3.5 Hole [0.14" Diameter]
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120mm[4.72"] 128mm[5.04"]
4mm[0.16"]
61.6mm[2.43"] 3mm[1.12"]
60mm[2.36"] (Max)
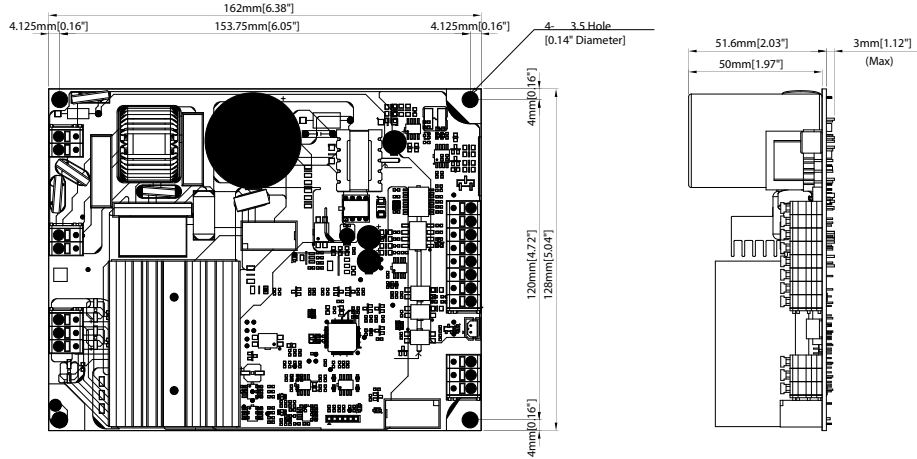
RVBS120075F

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Input specifications

	RVBS120055F	RVBS120075F
Rated input current	7.2 Arms	11 Arms
Input voltage range	Single phase: 200 - 240 VAC (+10% / -15%), 50/60 Hz	

Output specifications

	RVBS120055F	RVBS120075F
Rated output power	0.55 kW	0.75 kW
Output voltage range	3 - phase: 0 - 240 Vrms	
Output frequency range	0 - 90 Hz	
Frequency resolution	1 to 2 Hz (+/- 3 Hz)	
Switching frequency	2 kHz to 10 kHz	
Rated output current @ 40 °C	2.7 Arms	5 Arms
Duty cycle	60 sec ON (60 starts/hr) Acceleration time: 5 sec Deceleration time: 5 sec 10% ED (for braking)	

Digital inputs specifications

	RVBS120055F	RVBS120075F
Number of inputs	2	
Topology	NPN, 24V (Internally supplied)	
Function	Configurable (FWD, REV, Pre-set speed reference, Alarm reset)	

Analog input specifications

	RVBS120055F	RVBS120075F
Number of inputs	1	
Topology	0 - 10V	
Function	Speed command, 1EA	

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Digital output specifications

	RVBS120055F	RVBS120075F
Number of outputs	1	
Digital output Topology	Alarm relay Changeover (NO, NC)	
Relay rating	2 Arms @ 230 VAC	

Communication interface

Protocol	Modbus (RTU)
Function code	0x03h: Read holding registers (Maximum: 8 registers per command) 0x06h: Write single holding register
Type	Bi-directional (static and dynamic variables and parameters)
Functions	Parameter configuration and update Real-time monitoring of electrical variables Frequency setpoint and run/stop command
Physical layer	RS485
Data format	Data bits: 8 Parity: none Stop bits: 1
Baud rate	9,600 bits/s to 38,400 bits/s. Default: 19,200 bits/s

Communication settings

Parameter	Register	Keypad parameter	Default value	Range
Device address	0x0401h	Y01	1	1 - 255
Baud rate	0x0404h	Y04	1: 19,200 bits/s	0 : 9,600 bits/s 1 :19,200 bits/s 2: 38,400 bits/s
Parity	0x0406h	Y06	No parity	3: No parity
Stop bits	0x0407h	Y07	1 stop bit	1: 1 bit

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Performance

▶ **Current / power ratings: kW and HP @ 40 °C**

Model	IEC rated current	Rated output power	
RVBS120055F	2.7 Arms	0.55 kW	0.75 HP
RVBS120075F	5 Arms	0.75 kW	1 HP

Connection diagrams

▶ **Terminal markings**
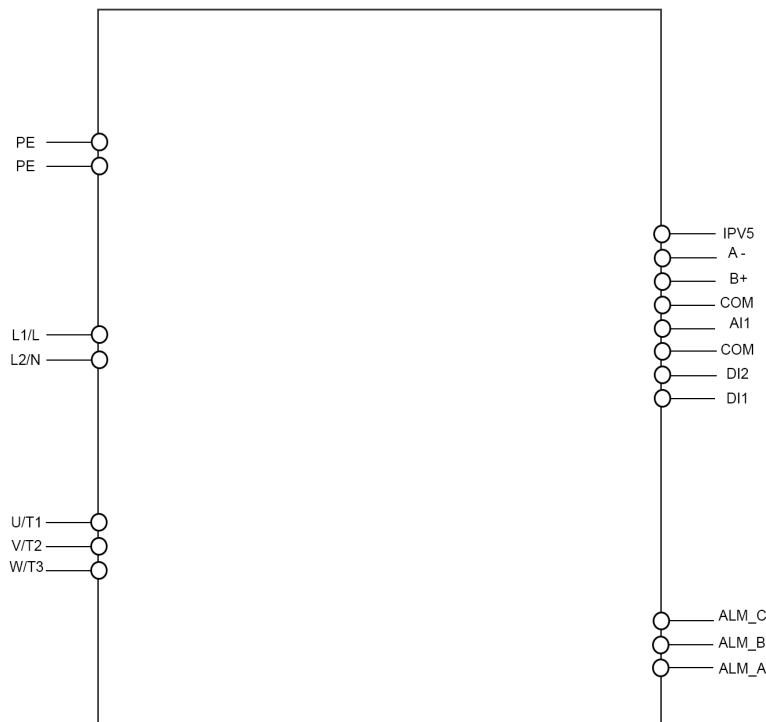
Function	Terminal marking
Line connections	L1 / L, L2 / N
Load connections	U / T1, V / T2, W / T3
Modbus connections	A-, B+
Functional ground	PE
Relay output (fault indication)	ALM_A, ALM_B, ALM_C
Analog input	AI1, COM
Digital inputs	DI1, DI2, COM
5 V Voltage reference output	IPV5

Note (1): Use shielded cables. The cable shield must be connected to ground.

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▶ **Connection specifications**

Function	Termination type	Wire dimensions	Stripping length
Line connections	Push-in	0.2 - 1.5 mm (26 - 16 AWG)	8 - 9 mm
Load connections			
Digital inputs			
Digital outputs			
Functional ground			
Modbus connection			

Note (1): Use shielded cables. The cable shield must be connected to ground.

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Troubleshooting

▶ **Alarms**

The RVBS includes a number of diagnostics and protection alarms. Each of these alarms is signalled through a flashing sequence on the red LED according to the tables shown below.

The alarm code is available through the keypad function code (D02 [register: 0x0502).

The last 4 alarms generated by RVBS are memorised in a FIFO alarm queue that can be accessed via the keypad function codes (D12 [register: 0x050C] to D15 [register: 0x050F]). The most recent alarm is stored in D12.

Number of flashes	1
Alarm code (on keypad)	Er8 or ErF
Alarm code (Modbus)	38 or 51
Alarm	Er8 (38): Modbus communications error ErF (51): Data saving error during under-voltage alarm
Alarm description	Er8 (38): Upon detection of an RS-485 communications error, the inverter stops its output. ErF (51): If the data could not be saved during activation of the under-voltage alarm, the inverter displays this alarm code.
Possible cause(s)	• Er8: Loss or errors detected in the communication • ErF: Under-voltage alarm active during data saving function
Reaction	Er8: Switch off output and activate alarm relay ErF: Alarm indication changes from under-voltage (LU) to data saving error (ErF). Inverter output should already be swithed off. Alarm relay will remain activated.
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊙ key + ⊙ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active)
Troubleshooting	• Er8: Check that there is a proper connection on the RJ45 terminals • ErF: Check that the mains voltage level i within limits

RVBS

Number of LED flashes	2
Alarm code (on keypad)	Er7
Alarm code (Modbus)	37
Alarm	Tuning error
Alarm description	The tuning error is triggered when the auto-tuning routine fails, is interrupted or an abnormal tuning result is detected during the tuning of mtor parameters.
Possible cause(s)	•
Reaction	Switch off output and activate alarm relay
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊚ key + ⌄ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Check that the motor is properly connected to the inverter

Number of LED flashes	3
Alarm code (on keypad)	OU1, OU2, OU3, LU
Alarm code (Modbus)	6, 7, 8, 10
Alarm	OU1: Over-voltage (during acceleration) OU2: Over-volage (during deceleration) OU3: Over-voltage (during steady state) LU: Under-voltage
Alarm description	OU1, OU2, OU3 [1]: The over-voltage alarm is triggered when the inverter detects an over-voltage (> 400 VDC) in the DC link bus during acceleration (OU1), deceleration (OU2) or steady state operation (OU3). LU [2]: The under-voltage alarm is triggered when the inverter detects a DC link bus voltage < 200 VDC. Note (1) : The over-voltage protection is not assured if excess AC line voltage is applied inadvartently. Note (2) : When function code F12 = 4 or 5, no alarm will be triggered even if the DC link bus is < 200 VDC.
Possible cause(s)	• OU1: Ramp-up time setting is too short • OU2: Ramp-down time setting is too short • OU3: Over-voltage on the mains network
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊚ key + ⌄ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Increase the acceleration and/or deceleration time • Use an external brake resistor if the alarm OU2 keep on triggering even after a longer ramp-up time has been set • OU3: check whether there are any surges on the mains network

RVBS

Number of LED flashes	4
Alarm code (on keypad)	Err
Alarm code (Modbus)	254
Alarm	Mock alarm
Alarm description	The mock alarm is used to simulate the reaction and sequence of events generated by the inverter in case of an alarm. This alarm can be triggered by setting the parameter H30 [register: 0x031E] to value 1.
Possible cause(s)	• This alarm is triggered intentionally by the user to check the correct sequence of events in case of an alarm generated by the inverter.
Reaction	When this alarm is triggered, Err will be displayed on the keypad screen (if available). The register 0x0502 will change to value 254 accordingly. The alarm relay is also activated to indicate the alarm condition.
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊙ key + ⊙ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Not applicable

Number of LED flashes	5
Alarm code (on keypad)	OC1, OC2, OC3
Alarm code (Modbus)	1, 2, 3
Alarm	OC1: Instantaneous over-current (during acceleration) OC2: Instantaneous over-current (during deceleration) OC3: Instantaneous over-current (during steady state)
Alarm description	This alarm is triggered in case of over-current resulting from: • overload condition • short circuit in the output circuit • ground fault in the output circuit Note: This function is effective only when the inverter is in Run state.
Possible cause(s)	• OC1: Accelaration time too short / too fast change in speed • OC2: Decelaration time too short / too fast change in speed • OC1, OC2, OC3: Motor is over-sized for the inverter
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊙ key + ⊙ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• OC1, OC2: Extend the acceleration and/or the deceleration time • OC3: Monitor the measured motor current during operation to check whether the current absorbed by the motor (especially at sppeds > 50 Hz) is larger than the maximum current allowed by the inverter

RVBS

Number of LED flashes	7
Alarm code (on keypad)	OH1
Alarm code (Modbus)	17
Alarm	Heatsink overheated
Alarm description	This alarm is triggered when the inverter detects an excess temperature on the heatsink
Possible cause(s)	• Too many starts per hour (duty cycle exceeded) • Acceleration time is too long • Deceleration time is too long • Overload condition
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the (STOP) key + (⌃) key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Reduce the acceleration and/or deceleration time • Check that the maximum number of starts/hr (60 / hr) is not exceeded • Check surrounding temperature

Number of LED flashes	8
Alarm code (on keypad)	OL1, OLU
Alarm code (Modbus)	22, 23, 25
Alarm	OL1: Motor overload OLU: Inverter overload
Alarm description	OL1: This alarm is triggered according to the setting of the electronic thermal overload relay to protect the motor. The operation level and thermal time constant can be configured. OLU: This alarm is triggered when the inverter heatsink temperature and the power unit temperature limits is exceeded.
Possible cause(s)	• Too many starts per hour (duty cycle exceeded) • Overload condition
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the (STOP) key + (⌃) key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• OL1: Check that the parameter P02 [register: 0x0202] for motor rated current is of the correct value • OLU: Check that the surrounding temperature around the inverter is within limits

RVBS

Number of LED flashes	9
Alarm code (on keypad)	OPL
Alarm code (Modbus)	46
Alarm	Output phase loss
Alarm description	This alarm is triggered when the inverter detects a fault in the output wiring during active states (running, acceleration and deceleration)
Possible cause(s)	• Loose connection on the load terminals U, V, W • Faulty motor winding
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊙ key + ⊙ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Check motor connections on the inverter • Measure the motor coils resistance

Number of LED flashes	Fully ON
Alarm code (on keypad)	Er1, Er3
Alarm code (Modbus)	31, 33
Alarm	Er1: Memory error Er3: CPU error
Alarm description	The inverter checks memory data after power-on and during a data write operation. If a memory error is detected, Er1 will be triggered. Er3 is triggered if the inverter detects a CPU error caused by externa noise/interference.
Possible cause(s)	• External noise in close proximity to the inverter • Use of unshielded cables
Reaction	Switch off output
Action to recover alarm	• Go to function code H19 [register: 0x0314] and set the value to 1. This action will clear the alarm. Note: To change the value in H19, press the ⊙ key + ⊙ key simultaneously. • Depending on the parameter setting for Retry function, the inverter will automatically reset and restart (if the Run command is active).
Troubleshooting	• Make sure that power cables are not in close proximity of the communication line and/or digital inputs • Ensure that cable shield is connected to ground • Connect the PE terminal to ground

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