Danfoss MCD 600 Modbus RTU Card Installation Guide

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Danfoss MCD 600 Modbus RTU Card

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Installing the Expansion Card

Procedure:

1. Push a small flat-bladed screwdriver into the slot in the center of the expansion port cover and ease the cover away from the soft starter.
2. Line up the card with the expansion port.
3. Gently push the card along the guide rails until it clicks into the soft starter.

Connecting to the Network

Prerequisites:
The expansion card must be installed in the soft starter.

Procedure:

1. Restore control power.
2. Connect field wiring via the 5-way connector plug.

Operation

Prerequisites
Ensure the expansion card is correctly installed and connected to the network.

Master Configuration
Configure the soft starter as the master device for Modbus communication.

Configuration

- **Modbus Network Settings:**
  Adjust network settings as required.
- **Enabling Network Control:**
  Enable network control for remote operation.
- **Feedback LEDs**
  Observe feedback LEDs to monitor system status.
- **Modbus Registers**
  Refer to the user manual for detailed information on Modbus registers, PLC configuration, compatibility, parameter management, standard mode, legacy mode, examples, trip codes, and Modbus error codes.

Safety

Disclaimer
The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. Responsibility or liability is never accepted for direct, indirect, or consequential damage resulting from the use or application of this equipment.

Warnings

SHOCK HAZARD
Attaching or removing accessories while the soft starter is connected to mains voltage may cause personal injury.
– Before attaching or removing accessories, isolate the soft starter from mains voltage.

RISK OF PERSONAL INJURY AND EQUIPMENT DAMAGE
Inserting foreign objects or touching the inside of the soft starter while the expansion port cover is open may endanger personnel and can damage the soft starter.

- Do not insert foreign objects in the soft starter with the port cover open.
- Do not touch the inside of the soft starter with the port cover open.

Important User Information

- Observe all necessary safety precautions when controlling the soft starter remotely. Alert personnel that machinery may start without warning.
- The installer is responsible for following all instructions in this manual and for following correct electrical practice.
- Use all internationally recognized standard practices for RS-485 communication when installing and using this equipment.

Installation

Installing the Expansion Card

Procedure

1. Push a small flat-bladed screwdriver into the slot in the center of the expansion port cover and ease the cover away from the soft starter.
2. Line up the card with the expansion port.
3. Gently push the card along the guide rails until it clicks into the soft starter.

Example:

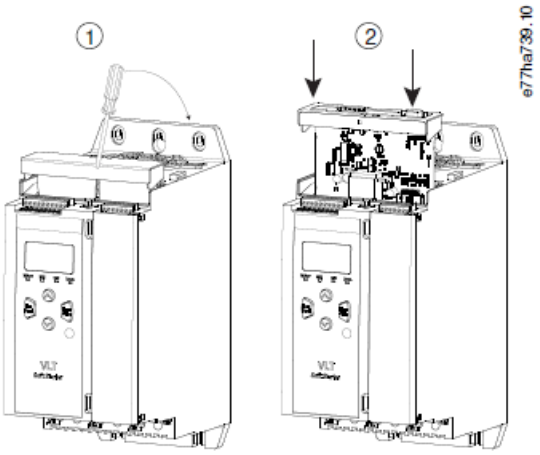

Illustration 1: Installation of the Expansion Cards

Connecting to the Network

Prerequisites:
The expansion card must be installed in the soft starter.

Procedure

1. Restore control power.
2. Connect field wiring via the 5-way connector plug.

Example:

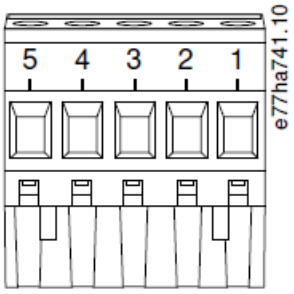

Illustration 2: 5-way Connector Plug

Pin	Function
1, 2	Data A
3	Common
4, 5	Data B

Operation

Prerequisites

The Modbus RTU Card must be controlled by a Modbus client (such as a PLC) that complies with the Modbus Protocol Specification. For successful operation, the client must also support all functions and interfaces described in this manual.

Master Configuration

- For standard Modbus 11-bit transmission, configure the master for 2 stop bits with no parity and 1 stop bit for odd or even parity. For 10-bit transmission, configure the master for 1 stop bit.
- In all cases, the master baud rate and slave address must match those set in parameters 12-1 to 12-4.
- The data polling interval must be long enough for the module to respond. Short polling intervals may cause inconsistent or incorrect behavior, particularly when reading multiple registers. The recommended minimum polling interval is 300 ms.

Configuration

Modbus Network Settings

Set the network communication parameters for the card via the soft starter. For details on how to configure the soft starter, see the VLT® Soft Starter MCD 600 Operating Guide.

Table 1: Parameter Settings

Parameter	Parameter name	Description
12-1	*Modbus Address*	Sets the Modbus RTU network address for the soft starter.
12-2	*Modbus Baud Rate*	Selects the baud rate for Modbus RTU communications.
12-3	*Modbus Parity*	Selects the parity for Modbus RTU communications.
12-4	*Modbus Timeout*	Selects the timeout for Modbus RTU communications.

NOTICE

The Modbus RTU Card reads communications parameter settings from the soft starter when control power is applied. If parameters are changed in the soft starter, the cycle control power is required for the new values to take effect.

Enabling Network Control

The soft starter only accepts commands from the expansion card if parameter 1-1 Command Source is set to Network.

NOTICE

If the reset input is active, the soft starter does not operate. If a reset switch is not required, fit a link across terminals RESET, COM+ on the soft starter.

LED status	Description
Off	The soft starter is not powered up.
On	Communication active.
Flashing	Communication inactive.

NOTICE
If communication is inactive, the soft starter may trip on Network Communications. If parameter 6-13 Network Communications is set to Soft Trip and Log or Trip Starter, the soft starter requires a reset.

Modbus Registers

NOTICE
All references to registers mean the registers within the device unless otherwise stated.

Compatibility
The Modbus RTU Card supports 2 modes of operation:

- In Standard Mode, the device uses registers defined in the Modbus Protocol Specification.
- In Legacy Mode, the device uses the same registers as the clip-on Modbus Module supplied by Danfoss for use with older soft starters. Some registers differ from those specified in the Modbus Protocol Specification.

Ensuring Safe and Successful Control

- Data written to the device remains in its registers until the data is overwritten or the device is reinitialized.
- If the soft starter should be controlled via parameter 7-1 Command Override or should be disabled via the reset input (terminals RESET, COM+), fieldbus commands should be cleared from the registers. If a command is not cleared, it is resent to the soft starter once fieldbus control resumes.

Parameter Management
Parameters can be read from and written to the soft starter. The Modbus RTU can read or write a maximum of 125 registers in 1 operation.

NOTICE

- The total number of parameters in the soft starter may vary according to the model and parameter list of the soft starter. Attempting to write to a register not associated with a parameter returns an error code 02 (illegal data address). Read register 30602 to determine the total number of parameters in the soft starter.
- Do not change the default values of the Advanced parameters (parameter group 20-** Advanced Parameters). Changing these values may cause unpredictable behavior in the soft starter.

Standard Mode

Command and Configuration Registers (Read/Write)

Table 2: Description of Read/Write Registers

Register	Description	Bits	Details
40001	Command (single write)	0–7	To send a command to the starter, write the required value: 00 000000 = Stop 00000001 = Start 00000010 = Reset 00000100 = Quick stop (coast to stop) 00001000 = Forced co mmunication trip 00010000 = Start using Parameter Set 1 001 00000 = Start using Parameter Set 2 01000000 = Reserved 10000000 = Reserved
		8–1 4	Reserved
		15	Must = 1
40002	Reserved		
40003	Reserved		
40004	Reserved		
40005	Reserved		
40006	Reserved		
40007	Reserved		
40008	Reserved		
40009–40x xx	Parameter management (single or multiple read/ writ e)	0–1 5	Manage soft starter programmable parameters. See the VLT® Soft Starter MCD 600 Operating Guide for a complete parame ter list.

Status Reporting Registers (Read Only)

NOTICE
For models MCD6-0063B and smaller (soft starter model ID 1~4), the current reported via communications registers is 10 times greater than the actual value.

Table 3: Description of Read Registers

Register	Description	Bits	Details
30003	Reserved		
30004	Reserved		
30005	Reserved		
30006	Reserved		
30007	Reserved		
30008	Reserved		
30600	Version	0–5	Binary protocol version
		6–8	Parameter list major version
		9–15	Product type code: 15 = MCD 600
30601	Model number	0–7	Reserved
		8–15	Soft starter model ID
30602	Changed parameter number	0–7	0 = No parameters have changed 1–255 = Index number of the last parameter changed
		8–15	The total number of parameters available in the soft starter
30603	Changed parameter value	0–15	Value of the last parameter that was changed, as indicated in register 30602

Register	Description	Bits	Details

30604	Starter state	0–4	0 = Reserved 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run si mulation, reset input is open) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		5	1 = Warning
		6	0 = Uninitialized 1 = Initialized
		7	Command source 0 = Remote Keypad, Digital Input, Clock 1 = Network
		8	0 = Parameters have changed since the last parameter read 1 = No parameters have changed
		9	0 = Negative phase sequence 1 = Positive phase sequence
		10–15	Reserved
		0–13	Average rms current across all 3 phases

30605	Current	14–15	Reserved
30606	Current	0–9	Current (% motor FLC)
		10–15	Reserved
30607	Motor temperature	0–7	Motor thermal model (%)
		8–15	Reserved

Register	Description	Bits	Details
30608	Power	0–11	Power
		12–13	Power scale 0 = Multiply power by 10 to get W 1 = Multiply power by 100 to get W 2 = Power (kW) 3 = Multiply power by 10 to get kW
		14–15	Reserved
30609	% Power factor	0–7	100% = power factor of 1
		8–15	Reserved
30610	Voltage	0–13	Average rms voltage across all 3 phases
		14–15	Reserved
30611	Current	0–13	Phase 1 current (rms)
		14–15	Reserved
30612	Current	0–13	Phase 2 current (rms)
		14–15	Reserved
30613	Current	0–13	Phase 3 current (rms)
		14–15	Reserved
30614	Voltage	0–13	Phase 1 voltage
		14–15	Reserved
30615	Voltage	0–13	Phase 2 voltage
		14–15	Reserved

30616	Voltage	0–13	Phase 3 voltage
		14–15	Reserved
30617	Parameter list version number	0–7	Parameter list minor revision
		8–15	Parameter list major version
30618	Digital input state	0–15	For all inputs, 0 = open, 1 = closed (shorted) 0 = Start/Stop 1 = Reserved 2 = Reset 3 = Input A 4 = Input B 5 to 15 = Reserved

Register	Description	Bits	Details
30619	Trip code	0–15	See 4.8 Trip Codes
		8–15	Reserved
30620–30631	Reserved		

NOTICE
Reading register 30603 (Changed parameter value) resets registers 30602 (Changed parameter number) and 30604 (Parameters have changed). Always read registers 30602 and 30604 before reading register 30603.

Legacy Mode

Registers

NOTICE

- For models MCD6-0063B and smaller (soft starter model ID 1~4), the current reported via communications registers is 10 times greater than the actual value.
- Legacy Mode reports read-only status information in registers 40003 onwards to match the register definitions of the clip-on Modbus Module. Identical data is also available via registers 30003 onwards.

Table 4: Description of Registers in Legacy Mode

Register	Description	Bits	Details
40001	Reserved		
40002	Command (single write)	0–2	To send a command to the starter, write the required value: 1 = Start 2 = Stop 3 = Reset 4 = Quick stop (coast to stop) 5 = Forced communication trip 6 = Start using Parameter Set 1 7 = Start using Parameter Set 2
		3–15	Reserved

Register	Description	Bits	Details
40003	Soft starter state	0–3	1 = Ready 2 = Starting 3 = Running 4 = Stopping (including braking) 5 = Restart delay (including temperature check) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		4	1 = Positive phase sequence (only valid if bit 6 = 1)
		5	1 = Current exceeds FLC
		6	0 = Uninitialized 1 = Initialized
		7–15	Reserved
40004	Reserved		
		0–7	Average 3-phase motor current (A)

40005	Motor current	8–15	Reserved
40006	Motor temperature	0–7	Motor thermal model (%)
		8–15	Reserved
40007	Reserved		
40008	Reserved		
40009–40xxx	Parameter management (single or multiple read/ write)	0–7	Manage soft starter programmable parameters. See the VLT ® Soft Start- er MCD 600 Operating Guide for a complete par ameter list.
		8–15	Reserved
40600	Version	0–5	Binary protocol version
		6–8	Parameter list version number
		9–15	Product type code: 15 = MCD 600
40601	Model number	0–7	Reserved
		8–15	Soft starter model ID

Register	Description	Bits	Details
40602	Changed parameter num ber	0–7	0 = No parameters have changed 1–255 = Index number of the last parameter changed
		8–15	The total number of parameters available in the soft starter
40603	Changed parameter value	0–15	Value of the last parameter that was changed, as indicated in register 40602

40604	Starter state	0–4	0 = Reserved 1 = Ready 2 = Starting 3 = Running 4 = Stopping 5 = Not ready (restart delay, restart temperature check, run si mulation, reset input is open) 6 = Tripped 7 = Programming mode 8 = Jog forward 9 = Jog reverse
		5	1 = Warning
		6	0 = Uninitialized 1 = Initialized
		7	Command source 0 = Remote Keypad, Digital Input, Clock 1 = Network
		8	0 = Parameters have changed since the last parameter read 1 = No parameters have changed
		9	0 = Negative phase sequence 1 = Positive phase sequence
		10–15	Reserved
40605	Current	0–13	Average rms current across all 3 phases

		14–15	Reserved
40606	Current	0–9	Current (% motor FLC)
		10–15	Reserved

Register	Description	Bits	Details
40607	Motor temperature	0–7	Motor thermal model (%)
		8–15	Reserved
40608	Power	0–11	Power
		12–13	Power scale 0 = Multiply power by 10 to get W 1 = Multiply power by 100 to get W 2 = Power (kW) 3 = Multiply power by 10 to get kW
		14–15	Reserved
40609	% Power factor	0–7	100% = power factor of 1
		8–15	Reserved
40610	Voltage	0–13	Average RMS voltage across all 3 phases
		14–15	Reserved
40611	Current	0–13	Phase 1 current (rms)
		14–15	Reserved
40612	Current	0–13	Phase 2 current (rms)
		14–15	Reserved
40613	Current	0–13	Phase 3 current (rms)
		14–15	Reserved
40614	Voltage	0–13	Phase 1 voltage
		14–15	Reserved
40615	Voltage	0–13	Phase 2 voltage
		14–15	Reserved
40616	Voltage	0–13	Phase 3 voltage
		14–15	Reserved
40617	Parameter list version number	0–7	Parameter list minor revision
		8–15	Parameter list major version

Register	Description	Bits	Details
40618	Digital input state	0–15	For all inputs, 0 = open, 1 = closed (shorted) 0 = Start/Stop 1 = Reserved 2 = Reset 3 = Input A 4 = Input B 5–15 = Reserved
40619	Trip code	0–7	See 4.8 Trip Codes
		8–15	Reserved
40620–40631	Reserved		

NOTICE
Reading register 40603 (Changed parameter value) resets registers 40602 (Changed parameter number) and 40604 (Parameters have changed). Always read registers 40602 and 40604 before reading register 40603.

Examples

Table 5: Command: Start

Message	Soft starter address	Function code	Register address	Data	CRC
In	20	06	40002	1	CRC1, CRC2
Out	20	06	40002	1	CRC1, CRC2

Table 6: Soft Starter State: Running

Message	Soft starter address	Function code	Register address	Data	CRC
In	20	03	40003	1	CRC1, CRC2
Out	20	03	2	xxxx0011	CRC1, CRC2

Table 7: Trip Code: Motor Overload

Message	Soft starter address	Function code	Register address	Data	CRC
In	20	03	40004	1	CRC1, CRC2
Out	20	03	2	00000010	CRC1, CRC2

Table 8: Download Parameter from Soft Starter – Read Parameter 5 (Parameter 1-5 Locked Rotor Current), 600%

Message	Soft starter address	Function code	Register	Data	CRC
In	20	03	40013	1	CRC1, CRC2
Out	20	03	2 (bytes)	600	CRC1, CRC2

Table 9: Upload Single Parameter to Soft Starter – Write Parameter 61 (Parameter 2-9 Stop Mode), set =1

Message	Soft starter address	Function code	Register	Data	CRC
In	20	06	40024	1	CRC1, CRC2
Out	20	06	40024	1	CRC1, CRC2

Table 10: Upload Multiple Parameters to Soft Starter – Write Parameters 9, 10, 11 (Parameters 2-2 to 2-4) Set to Values of 15 s, 300%, and 350%, Respectively

Message	Soft starter address	Function code	Register	Data	CRC
In	20	16	40017, 3	15, 300, 350	CRC1, CRC2
Out	20	16	40017, 3	15, 300, 350	CRC1, CRC2

NOTICE
This function can only be used to upload consecutive parameters. The Register field indicates the number of parameters to be uploaded and the register number of the 1st parameter.

Trip Codes

Code	Description
0	No trip
1	Excess start time
2	Motor overload
3	Motor thermistor
4	Current imbalance
5	Frequency
6	Phase sequence
7	Instantaneous overcurrent
8	Power loss
9	Undercurrent
10	Heatsink overtemperature
11	Motor connection
12	Input A trip
13	FLC too high
14	Unsupported option (function not available inside the delta)
15	Communications card fault
16	Forced network trip
17	Internal fault
18	Overvoltage
19	Undervoltage
23	Parameter out of range
24	Input B trip
26	L1 phase loss
27	L2 phase loss
28	L3 phase loss
29	L1-T1 shorted
30	L2-T2 shorted
31	L3-T3 shorted
33	Time-overcurrent (bypass overload)

Code	Description
34	SCR overtemperature
35	Battery/clock
36	Thermistor circuit
47	Overpower
48	Underpower
56	LCP disconnected
57	Zero speed detect
58	SCR itsm
59	Instantaneous overcurrent
60	Rating capacity
70	Current read err L1
71	Current read err L2
72	Current read err L3
73	Remove mains volts (mains voltage connected in run simulation)
74	Motor connection T1
75	Motor connection T2
76	Motor connection T3
77	Firing fail P1
78	Firing fail P2
79	Firing fail P3
80	VZC fails P1
81	VZC fails P2
82	VZC fails P3
83	Low control volts
84–96	Internal fault x. Contact the local supplier with the fault code (x).

Modbus Error Codes

Code	Description	Example
1	Illegal function code	The adapter or soft starter does not support the requested function.
2	Illegal data address	The adapter or soft starter does not support the specified register address.
3	Illegal data value	The adapter or soft starter does not support 1 of the received data values.
4	Slave device error	An error occurred while trying to perform the requested function.
6	Slave device busy	The adapter is busy (for example, writing parameters to the soft starter).

Specifications

- Soft starter 6-way pin assembly
- Network 5-way male and unpluggable female connector (supplied)
- Maximum cable size 2.5 mm2 (14 AWG)

Settings

- Protocol Modbus RTU, AP ASCII
- Address range 0–254
- Data rate (bps) 4800, 9600, 19200, 38400
- Parity None, Odd, Even, 10-bit
- Timeout None (Off), 10 s, 60 s, 100 s

Certification

- RCM IEC 60947-4-2
- CE EN 60947-4-2
- RoHS Compliant with EU Directive 2011/65/EU

- Danfoss A/S
- Ulsnaes 1
- DK-6300 Graasten
- vlt-drives.danfoss.com

Frequently Asked Questions

- **Q: Can I insert foreign objects into the soft starter with the port cover open?**

  A: No, do not insert foreign objects in the soft starter with the port cover open, as it may endanger personnel and damage the equipment.

- **Q: What safety precautions should be observed when controlling the soft starter remotely?**
  A: Observe all necessary safety precautions and alert personnel that machinery may start without warning. Follow correct electrical practices and use internationally recognized standard practice for RS-485 communication.

Documents / Resources

	Danfoss MCD 600 Modbus RTU Card [pdf] Installation Guide AQ277154312778, MCD 600 Modbus RTU Card, Modbus RTU Card, RTU Card

References

- Danfoss Drives: World-leading drive manufacturer | Danfoss
- User Manual