



iC2-Micro Frequency Converters

1 Introduction

This Operating Guide provides necessary information for qualified personnel to install and commission the AC drive. Read and follow the instructions to use the drive safely and professionally.



Do not dispose of equipment containing electrical components together with domestic waste. Collect it separately in accordance with local and currently valid legislation.

2 Safety

Pay particular attention to the safety instructions and general warnings to avoid the risk of death, serious injury, and equipment or property damage.

🗚 W A R N I N G 🗚

HIGH VOLTAGE

AC drives contain high voltage when connected to AC mains input, DC supply, or load sharing.

LININTENDED START

The motor may start from control panel, I/O inputs, fieldbus, or MyDrive® Insight at any time, when the drive is connected to the AC mains, DC supply, or load sharing

DISCHARGE TIME

The drive contains DC-link capacitors, which can remain charged even when the drive is not powered. High voltage can be present even when the warning indicator lights are off.

- Stop the motor, and disconnect AC mains, permanent magnet type motors, and remove DC-link supplies, including battery back-ups, UPS, and DC-link connections to other drives.

Wait for the capacitors to discharge fully and measure it before performing any service or repair work.

The minimum waiting time is 4 minutes for MA01c, MA02c, MA01a, and MA02a drives, and 15 minutes for MA03a, MA04a, and MA05a drives.

LEAKAGE CURRENT

Leakage currents of the drive exceed 3.5 mA. Make sure that the minimum size of the ground conductor complies with the local safety regulations for high touch current equipment.

3 Installation

3.1 Mechanical Dimensions

Enclosure size	Height [mm (in)]			Width [mm (in)]		Depth [mm (in)] ⁽²⁾	Mounting holes [mm (in)]	B Ø C		
size	A A ⁽¹⁾ a		a	B b		C D				
MA01c	150 (5.9)	216 (8.5)	140.4 (5.5)	70 (2.8)	55 (2.2)	143 (5.6)	4.5 (0.18)			
MA02c	176 (6.9)	232.2 (9.1)	150.5 (5.9)	75 (3.0)	59 (2.3)	157 (6.2)	4.5 (0.18)	a A		
MA01a	150 (5.9)	202.5 (8.0)	140.4 (5.5)	70 (2.8)	55 (2.2)	158 (6.2)	4.5 (0.18)			
MA02a	186 (7.3)	240 (9.4)	176.4 (6.9)	75 (3.0)	59 (2.3)	175 (6.9)	4.5 (0.18)			
MA03a										
MA04a		Data for N								
MA05a										
Enclosure			Р	ower [kW	(hp)]			Maximum weight ⁽³⁾		
size		1x200-24	0 V		3x380-480 V			[kg (lb)]		
MA01c		0.37-0.75 (0.5	5–1.0)		_			1.0 (2.4)		
MA02c		1.5 (2.0))		_			1.3 (2.9)		
MA01a	_				0.37–1.5 (0.5–2.0)			1.1 (2.4)		
MA02a	2.2 (3.0)				2.2-4.0 (3.0-5.4)			1.6 (3.5)		
MA03a										
MA04a		Data for MA03a to MA05a will be available in next release.								
MA05a										

Note: (1) Including decoupling plate.

(3) Not including decoupling plate.

3.2 Connecting to Mains and Motor

- · Mount the ground wires to the PE terminal.
- Connect motor to terminals U, V, and W.
- \bullet Mount mains supply to terminals L1/L, L2, and L3/N (3-phase) or L1/L and L3/N (single-phase) and tighten.
- For required maximum screwing torque, see the back of terminal cover.

3.3 Load Sharing/Brake

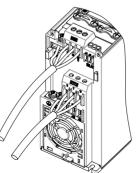
Use 6.3 mm (0.25 in) insulated connectors designed for high voltage for DC (load sharing and brake).

Contact Danfoss or refer to the drive's Design Guide.

Table 1: Connect Terminals

Load sharing	-UDC and +UDC/+BR					
Brake	-BR and +UDC/+BR					
Recommended connector type (only for drives below 7.5 kW/10 hp): Ultra-Pod						

Fully Insulated FASTON Receptacles and Tabs, 521366-2, TE connectivity.



(2) The potentiometer on the local control panel extends 6.5 mm (0.26 in) from the drive.

Illustration 1: Mounting of Ground Cable, Mains, and Motor Wires

NOTICE

Voltage levels of up to 850 V DC may occur between terminals +UDC/+BR and -UDC. Not short-circuit protected.

3.4 Control Terminals

- All control cable terminals are located underneath the terminal cover in front of the drive.
- See the back of the terminal cover for outlines of control terminals and switches

Remove the terminal cover with a screwdriver, see illustration 2

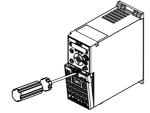


Illustration 2: Removing Terminal Cover

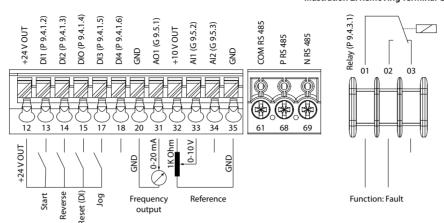


Illustration 3: Overview of Control Terminals in PNP-configuration with Factory Setting (Speed Control Mode)

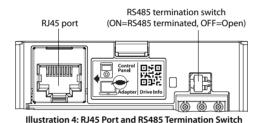
3.5 RJ45 Port and RS485 Termination Switch

iC2-Micro drive has a RJ45 port which complies with Modbus 485 protocol.

The RJ45 port is used for connecting:

- External control panel.⁽¹⁾
- PC tool (MyDrive® Insight) via an adapter.(1)
- Offline configuration tool for parameter settings when the drive is not powered on.(1)

Note: (1) The tool is not available currently.



NOTI CE

- The RJ45 port supports up to 3 m (9.8 ft) of shielded CAT5e cable which is NOT used to directly connect the drive to a PC Failure to follow this notice causes damage to the PC.
- RS485 termination switch should be set to **ON** if the drive is at the end of the fieldbus.
- Do not operate RS485 termination switch when the drive is powered on.

4 Programming

4.1 Control Panel

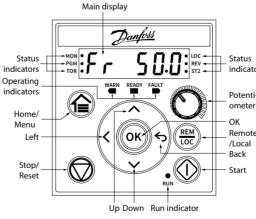


Illustration 5: Indicators and Operation Keys

Table 2: Operation Keys and Potentiometer

Ivaille	FullCuon					
Home/Menu	(1) Toggles between status display and main menu. (2) Long press to access the shortcut menu for quickly reading and editing parameters. ⁽¹⁾					
Up/Down	Switches status/parameter group/parameter numbers, and tunes the parameter values.					
Left	Moves the cursor 1 bit to the left.					
Back	Navigates to the previous step in the menu structure or cancels the setting during tuning parameter values.					
OK	Confirms the operation.					
Remote/Local	Toggles between remote and local mode.					
Start	Starts the drive in local mode.					
Stop/Reset	Stops the drive in local mode, or resets the drive to clear a fault.					
Potenti- ometer	Changes the reference value when the reference value is selected as potentiometer.					
	manus managers in managers in label and accommendation					

Note: (1) The shortcut menu is not available currently

Table 3: Status and Operating Indicator Lights

Name	Function		Name		Function	
MON	On	Shows the drive status.	DEM	On	On The drive is in reverse direction.	
PGM	On The drive is in programming status.		REV	Off	The drive is in forward direction.	
TOR	On	The drive is in torque mode.	ST2	Refer	Refer to Table 5 Multiple Setups.	
IOR	Off	The drive is in speed mode.	WARN	Stead	lily lit when a warning occurs.	
LOC	On The drive is in local mode.		READY	Stead	lily lit when the drive is ready.	
LOC	Off	The drive is in remote mode.	FAULT	Flash	es when a fault occurs.	

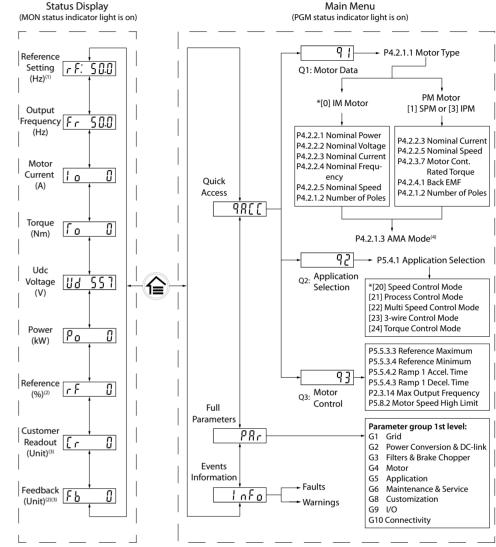
Table 4: Run Indicator Lights

Table 5: Multiple Setups

On	Flash	Flash quickly
Setup 2	Setup 1	Setup 2
Setup 2	Setup 2	Setup 1
		a Setun
	Setup 2	Setup 2 Setup 1 Setup 2 Setup 2 6.6.1 Active Setup. Inneter P6.6.2 Programmin

4.2 Operation with Control Panel

After the drive is powered up, press the Home/Menu key to toggle between status display and main menu. Use the **Up/Down** keys to select items, and press the **OK** key to confirm selection.



Note: (1) Local mode only. (2) Remote mode only. (3) The status is only shown when the corresponding function is enabled. (4) For AMA execution, refer to chapter Automatic Motor Adaptation (AMA). If parameter P5.4.3 Motor Control Principle is set as [0] U/f, no need to execute AMA.

Illustration 6: Operation with Control Pane

4.3 Automatic Motor Adaptation (AMA)

- Via running AMA in VVC+ mode, the drive builds a mathematical model of the motor to optimize compatibility between drive and motor, and thus enhances the motor control performance.
- Some motors may be unable to run the complete version of the test. In that case, select [2] Enable Reduced AMA in parameter P4.2.1.3 AMA Mode.
- AMA completes within 5 minutes. For best results, run the following procedure on a cold motor.

Procedure:

- 1. Set motor data according to the motor nameplate.
- 2. If needed, set motor cable length in parameter P4.2.1.4 Motor Cable Length.
- 3. Set [1] Enable Complete AMA or [2] Enable Reduced AMA for parameter P4.2.1.3 AMA Mode, the main display shows To start AMA, see illustration 7.
- 4. Press the Start key, the test runs automatically and the main display indicates when it is completed.
- 5. When AMA is completed, press any key to exit and return to normal operation mode.



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5 Troubleshooting

Number	Description	Warning	Fault	Trip lock	Cause
				IOCK	Signal on terminal 33 or 34 is less than 50% of the value set in <i>par</i>
2	Live zero error	х	х	-	ameter P9.5.2.3 T33 Low Voltage, parameter P9.5.2.5 T33 Low Curren parameter P9.5.3.3 T34 Low Voltage, and parameter P9.5.3.5 T34 Lov Current.
3	No motor	Х	-	-	No motor has been connected to the output of the drive.
4	Mains phase loss(1)	Х	х	Х	Missing phase on the supply side, or the voltage imbalance is too high. Check the supply voltage.
7	DC overvoltage ⁽¹⁾	Х	Х	-	DC-link voltage exceeds the limit.
8	DC undervoltage ⁽¹⁾	X	X	-	DC-link voltage drops below the voltage warning low limit.
9	Inverter overloaded	X	Х	-	More than 100% load for too long.
10	Motor ETR overtemp- erature	Х	Х	-	Motor is too hot due to more than 100% load for too long.
11	Motor thermistor overtemperature	Х	Х	-	Thermistor or thermistor connection is disconnected, or the moto is too hot.
12	Torque limit	Х	Х	-	Torque exceeds the value set in either parameter P5.10.1 Motor Torque Limit or parameter P5.10.2 Regenerative Torque Limit.
13	Overcurrent	x	х	Х	Inverter peak current limit is exceeded. If this fault occurs on power-up, check whether power cables are mistakenly connected to the motor terminals.
14	Ground fault		Х	Х	Discharge from output phases to ground.
16	Short circuit		Х	Х	Short circuit in motor or on motor terminals.
17	Control word timeout	Х	Х	-	No communication to the drive.
25	Brake resistor short-	_	Х	Х	Brake resistor is short-circuited, thus the brake function is discon-
26	circuited Brake overload	Х	х	-	nected. The power transmitted to the brake resistor over the last 120 s exceeds the limit. Possible corrections: Decrease brake energy via lower speed or longer ramp time.
27	Brake IGBT/Brake chopper short-circuited	_	Х	Х	Brake transistor is short-circuited, thus brake function is disconnected.
28	Brake check	_	Х	-	Brake resistor is not connected/working.
30	U phase loss	-	Х	Х	Motor phase U is missing. Check the phase.
31	V phase loss	-	Х	Х	Motor phase V is missing. Check the phase.
32	W phase loss	-	Х	Χ	Motor phase W is missing. Check the phase.
36	Mains failure	x	х	-	This warning/fault is only active if the supply voltage to the drive i less than the value set in parameter P2.3.7 Power Loss Controller Limit, and parameter P2.3.6 Power Loss Action is NOT set to [0] No Function.
38	Internal fault	-	Х	Х	Contact the local supplier.
40	Overload T15	Х	-	-	Check the load connected to terminal 15 or remove short-circuit connection.
46	Gate drive voltage fault		Х	-	-
47	24 V supply low	Х	Х	Х	24 V DC may be overloaded.
50	AMA calibration failed		Х	-	A calibration error has occurred.
51	AMA check U _{nom} and I _{nom}	-	Х	-	Wrong setting for motor voltage and/or motor current.
52	AMA low I _{nom}	_	Х	-	Motor current is too low. Check the settings.
53	AMA big motor	-	Х	-	The power size of the motor is too large for the AMA to operate.
54 55	AMA small motor AMA parameter range	_	X	-	The power size of the motor is too small for the AMA to operate. The parameter values of the motor are outside of the acceptable
					range. AMA does not run.
56 57	AMA interrupt AMA timeout	_	X	-	The AMA is interrupted.
58	AMA internal	_	X	_	Contact the local supplier.
59	Current limit	X	X	_	The drive is overloaded.
60	External Interlock	_	X	_	External interlock has been activated.
61	Feedback error	Х	Х	_	_
63	Mechanical brake low	-	х	-	Actual motor current has not exceeded release brake current within start delay time window.
69	Power card temp	х	Х	Х	The cutout temperature of the power card has exceeded the uppelimit.
80	Drive initialized to default value	-	Х	ı	All parameter settings are initialized to default settings.
87	Auto DC brake	x	-	-	Occurs in IT mains when the drive coasts, and the DC voltage is higher than 830 V for 400 V units and 425 V for 200 V units. The motor consumes energy on the DC link. This function can be enabled/disabled in <i>parameter P2.3.13 Auto DC Braking</i> .
95	Broken belt	Х	Х	-	-
99	Locked rotor	-	Х	-	Rotor is blocked.
126	Motor rotating	-	Х	-	PM motor is rotating when AMA is performed.
127	Back EMF too high	Х	-	-	The back EMF of PM motor is too high before starting.
Err. 89	Parameter read only	-	-	-	Parameters cannot be changed.
Err. 95	Not while running	-	-	-	Parameters can only be changed when the motor is stopped.
					16 1 1
Err. 96	A wrong password was entered	_	_	_	Occurs when using a wrong password for changing a password- protected parameter.

6 Specifications

Table 7: Mains Supply 1x200-240 V AC

Normal overload 150% for 1 minute								
Drive	02A2	04A2	06A8	09A6				
Typical shaft output [kW (hp)]	0.37 (0.5)	0.75 (1.0)	1.5 (2.0)	2.2 (3.0)				
Enclosure protection rating IP20	MA01c	MA01c	MA02c	MA02a				
Output current								
Continuous (3x200-240 V) [A]	2.2	4.2	6.8	9.6				
Intermittent (3x200–240 V) [A]	3.3	6.3	10.2	14.4				
Maximum cable size (Mains, motor) [mm²/AWG]	4/10							
Maximum input current								
Continuous (1x200–240 V) [A]	6.1	11.6	18.7	26.4				
Intermittent (1x200–240 V) [A]	8.3	15.6	26.4	37				

Table 8: Mains Supply 3x380-480 V AC MA01a-MA02a

Normal overload 150% for 1 minu	te					
Drive	01A2	02A2	03A7	05A3	07A2	09A0
Typical shaft output [kW (hp)]	0.37 (0.5)	0.75 (1.0)	1.5 (2.0)	2.2 (3.0)	3.0 (4.0)	4.0 (5.5)
Enclosure protection rating IP20	MA01a	MA01a	MA01a	MA02a	MA02a	MA02a
Output current						
Continuous (3x380-440 V) [A]	1.2	2.2	3.7	5.3	7.2	9.0
Intermittent (3x380-440 V) [A]	1.8	3.3	5.6	8.0	10.8	13.7
Continuous (3x440-480 V) [A]	1.1	2.1	3.4	4.8	6.3	8.2
Intermittent (3x440–480 V) [A]	1.7	3.2	5.1	7.2	9.5	12.3
Maximum cable size (Mains, motor) [mm²/AWG]			4/10			
Maximum input current						
Continuous (3x380–440 V) [A]	1.9	3.5	5.9	8.5	11.5	14.4
Intermittent (3x380-440 V) [A]	2.6	4.7	8.7	12.6	16.8	20.2
Continuous (3x440-480 V) [A]	1.7	3.0	5.1	7.3	9.9	12.4
Intermittent (3x440-480 V) [A]	2.3	4.0	7.5	10.8	14.4	17.5

Table 9: Mains Supply 3x380-480 V AC MA03a-MA05a

Normal overload 150% for 1 minut	te					
Drive	12A0	15A5	23A0	31A0	37A0	43A0
Typical shaft output [kW (hp)]	5.5 (7.5)	7.5 (10)	11 (15)	15 (20)	18.5 (25)	22 (30)
Enclosure protection rating IP20	MA03a	MA03a	MA04a	MA04a	MA05a	MA05a
Output current						
Continuous (3x380-440 V) [A]	1					
Intermittent (3x380-440 V) [A]						
Continuous (3x440-480 V) [A]	7					
Intermittent (3x440-480 V) [A]	1					
Maximum cable size (Mains, motor) [mm²/AWG]		Data for MA	03a to MA05a v	vill be available	in next release.	
Maximum input current	1					
Continuous (3x380-440 V) [A]	1					
Intermittent (3x380-440 V) [A]	1					
Continuous (3x440-480 V) [A]]					
Intermittent (3x440–480 V) [A]	1					

7 Ambient Conditions

Protection rating		IP20 (IP21/Type 1 conversion kit as option).			
Temperature during operation		-10 °C to 50 °C (14 °F to 122 °F), up to 55 °C (131 °F) with derating.			
Temperature during storage/transport		-25 °C to 65/70 °C (-13 °F to 149/158 °F).			
Relative humidity		5–95%, non-condensing during operation.			
Altitude		0–1000 m (3280 ft) without derating.			
Aititude		1000–3000 m (3280–9243 ft) with derating of 1%/100 m (328 ft).			
	Storage	IEC 60721-3-1, Class 1C2 (aggressive gases), Class 1S11 (dust/sand).			
Contamination level	Transportation	IEC 60721-3-2, Class 2C2 (aggressive gases), Class 2S5 (dust/sand).			
	Operation	IEC 60721-3-3, Class C4 (aggressive gases), Class 3S6 (dust/sand).			
	Storage	IEC 60721-3-1, Class 1M11.			
Mechanical conditions	Transportation	IEC 60721-3-2, Class 2M5.			
	Operation	IEC 60721-3-3, Class 3M11.			

8 Mounting Clearance

Table 10: Minimum Mounting Clearance

Enclosure size	Minimun mounting clearance [maximum temperature 50 °C (122 °F)]				
All enclosure sizes	Above and below: 100 mm (3.9 in).				
MA01a-MA05a, MA02c	Sides: 0 mm (0 in).				
MA01c (natural cooling)	Sides: 0 mm (0 in) for 40 °C (104 °F), 10 mm (0.39 in) and above for 50 °C (122 °F).				

9 EMC Compatibility and Motor Cable Length

iC2-Micro drive has 2 versions based on different EMC filter types:

(1) Drive with built-in EMC filter. (2) Drive with non built-in EMC filter.

Table 11: EMC Co	ompatibility Motor Cable	Length	Table 12: Maximum Motor Cable Length			
Orive with built-	Maximum motor cable l	ength (shielded), @4kHz		Shielded	50 m (164 ft)	
n EMC filter	C1 (Conducted)	C2 (Conducted)	Maximum motor	Silielded	30 111 (10411)	
1x200-240 V	5 m (16.4 ft)	-	cable length	Unshielded	75 m (246 ft)	
3x400-480 V	-	15 m (49.2 ft)		Orisilielded	75111 (24011)	

- Drive with built-in EMC filter fulfills radiated emission C2 limits.
- Drive with non built-in EMC filter fulfills conducted/radiated emission C4 requirements, and shielded motor cable is recommended.
- The drive is designed to operate with optimum performance within the maximum motor cable lengths defined in *Table 12 Maximum Motor Cable Length*.

10 Fuses and Circuit Breakers

iC2-Micro kW (hp)	Non cabinet					Cabinet			
	UL fuse				CE fuse	UL circuit breaker	CE circuit breaker	Test cabinet size	Minimum
	RK1 T J CC Standard fault current rating 5 kA			cc	gG	ABB	EATON	[Height x Width x	cabinet
Standard fault				-	5 kA	_	Depth] [mm (in)]	volume [L	
High fault	_			-	65 kA	-			
1x200-240 V								•	
0.37 (0.5)	25 A				MS165-25	PKZM4-25	500 x 400 x 260 (19.7 x 15.7 x 10.2)	52	
0.75 (1.0)									
1.5 (2.0)	35 A				MS165-32	PKZM4-32			
2.2 (3.0)	40 A			50 A	MS165-42	PKZM4-50			
3x380-480 V								•	
0.37 (0.5)				MS165-16	PKZM0-16	500 x 400 x 260 (19.7 x 15.7 x 10.2)	52		
0.75 (1.0)	15 A							16 A	
1.5 (2.0)									
2.2 (3.0)			40 A	MS165-32	PKZM4-32				
3.0 (4.0)	30 A								
4.0 (5.5)									
5.5 (7.5)									
7.5 (10)	Data for MA03a to MA05a will be available in next release.								
11 (15)									
15 (20)									
18.5 (25)									
22 (30)									

11 Accessories and Spare Parts

Accessories	Code number	Accessories	Code number	
IP21/Type 1 conversion kit, MA01c	132G0188	Decoupling plate mounting kit, MA01c	132G0202	
IP21/Type 1 conversion kit, MA02c	132G0189	Decoupling plate mounting kit, MA02c	132G0203	
IP21/Type 1 conversion kit, MA01a	132G0190	Decoupling plate mounting kit, MA01a	132G0204	
IP21/Type 1 conversion kit, MA02a	132G0191	Decoupling plate mounting kit, MA02/03a	132G0205	
IP21/Type 1 conversion kit, MA03a	132G0192	Decoupling plate mounting kit, MA04/05a	132G0206	
IP21/Type 1 conversion kit, MA04a	132G0193	Connector for common DC/brake resistor	132G0207	
IP21/Type 1 conversion kit, MA05a 132G01				
NEMA 1 conversion kit, MA01c	132G0195		Not available currently.	
NEMA 1 conversion kit, MA02c	132G0196	HMI and related accessories		
NEMA 1 conversion kit, MA01a	132G0197			
NEMA 1 conversion kit, MA02a	132G0198			
NEMA 1 conversion kit, MA03a	132G0199	Harmonic and EMC filter	Refer to the Design Guide.	
NEMA 1 conversion kit, MA04a	132G0200	Brake resistors		
NEMA 1 conversion kit, MA05a	132G0201	dU/dt filter	2 cs.g dalac.	

Spare parts	Code number		
Cooling fan	Refer to the Design Guide.		
Spare parts kit			

12 Technical Documentation

Scan the QR code (or, after scanning the QR code, click **Global English** to select your local region's website), and search **iC2** to access more technical documents.



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