Substitution Guideline

MC NEMA 4, 4X, 12 ➜ i550 protec IP66, IP54

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Content

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1 Use of document

This document is a guideline for the replacement of MC NEMA 4, 4X, 12 with i550 protec IP66, IP54 inverter and can be used by Application Engineers, Sales and Project Management.

It shows the following:
- Suitability of i550 protec IP66, IP54 instead of MC NEMA 4, 4X, 12 inverter
- Replacement engineering help

NOTICE! For detailed engineering, the technical documents have to be considered!

NOTICE! Comparison is based on i500 state as of HMI 2018.

2 Why should I change?

The i550 protec is the new inverter series in the 0.5 to 15 hp (0.37 to 11 kW) power range. Its distinguishing features: a slim design, scalable functionality and exceptional user-friendliness.

Going decentral is recommended most of all for large machines to save installation costs or where cabinet space is limited.

The i550 protec is designed for motor applications where dynamic speed and torque control is demanded, making the units ideal for many applications like conveyors, packaging equipment plus fan and pump systems.

Based on the established hardware and software of the i500 cabinet inverters — this means same drive functionality and user interaction.

Highlights

- Ingress protection of IP66 (NEMA 4X) with protection against high pressure water jets from any direction and dust tightness allows for use in harsh environment applications
- First decentral drive in the market with IO-Link Device Interface
- Sensorless synchronous motor control
- Intuitive user interface for fast setup and an easy navigation parameter structure
- EPM module for simple series commissioning and device replacement
- USB Micro diagnostic interface on board
- Optionally equipped with keypad or WLAN diagnostic module

3   Replacement unit

The following list shows an overview of the available product range:

MC NEMA4, NEMA4X, NEMA12											
		1x120V		1x230V		3x230V		3x480V		3x600V	
hp	kW	MC model	i550	MC model	i550	MC model	i550	MC model	i550	MC model	i550
0.33	0.25	Mx103Sy	Y*								
0.50	0.37	Mx105Sy	Y	Mx205Sy	Y	Mx205y	Y				
1.0	0.75	Mx110Sy	Y	Mx210Sy	Y	Mx210y	Y	Mx410y	Y	Mx510y	Y
1.5	1.1	Mx115Sy	Y	Mx215Sy	Y	Mx215y	Y				
2.0	1.5			Mx220Sy	Y	Mx220y	Y	Mx420y	Y	Mx520y	Y
3.0	2.2			Mx230Sy	Y	Mx230y	Y	Mx430y	Y	Mx530y	Y
5.0	4.0					Mx250y	Y	Mx450y	Y	Mx551y	Y
7.5	5.5					Mx275y	Y	Mx475y	Y	Mx575y	Y
10.0	7.5					Mx2100y	Y	Mx4100y	Y	Mx5100y	Y
15.0	11.0					Mx2150y	Y	Mx4150y	Y	Mx5150y	Y
20.0	15.0					Mx2200D	Y	Mx4200y	Y	Mx5200y	Y
25.0	18.5					Mx2250D	Y	Mx4250D	Y	Mx5250D	Y
30.0	22.0					Mx2300D	N	Mx4300D	Y	Mx5300D	Y
40.0	30.0							Mx4400D	Y	Mx5400D	N
50.0	37.0							Mx4500D	Y	Mx5500D	N
60.0	45.0							Mx4600D	Y	Mx5600D	N
75.0	55.0							Mx4750D	Y		
100.0	75.0							Mx41000D	Y		
125.0	90.0							Mx41250D	N		

Notes:
x=1 (MC1000) or 3 (MC3000)
y=C (NEMA 4) or E (NEMA 4X) - Offering in i550 protec is NEMA 4X only with Polycarbonate enclosure
*Note substitution uses higher power rating
S - Substitute with i550 protec IP54 rated drive

ℹ️ **iMPORTANT:** Prior to installation it is the drive user's responsibility to ensure the selected enclosure is suitable for use under the environmental conditions it will be exposed. Temperature, presence of airborne contaminants, chemical concentration, mechanical stress, and duration of exposure are examples of variables that can influence suitability to a particular environment.

MC to i5x0 protec cross substitution part numbers

NEMA 4					
Input Line Voltage		120V or 240V (1Ø)		208-240V (1Ø)	
hp	kW	MC Series	i5x0 protec (120V ONLY)	MC Series	i5x0 protec
0.25	0.18	M1103SC	I55AP137A00701K03S		
		M3103SC			
0.5	0.37	M1105SC	I55AP137A00701K03S	M1205SC	I55AP137D00701K03S
		M3105SC		M3205SC	
1	0.75	M1110SC	I55AP175A00701K03S	M1210SC	I55AP175D00701K03S
		M3110SC		M3210SC	
1.5	1.1	M1115SC	I55AP211A00701K03S	M1215SC	I55AP211D00701K03S
		M3115SC		M3215SC	
2	1.5			M1220SC	I55AP215D00701K03S
				M3220SC	
3	2.2			M1230SC	I55AP222D00701K03S
				M3230SC	

NEMA 4					
Input Line Voltage		208-240V (3Ø)		400-480V (3Ø)	
hp	kW	MC Series	i5x0 protec	MC Series	i5x0 protec
0.5	0.37	M1205C	I55AP137D00701K03S		
		M3205C			
1	0.75	M1210C	I55AP175D00701K03S	M1410C	I55AP175F00711K03S
		M3210C		M3410C	
1.5	1.1	M1215C	I55AP211D00701K03S		
		M3215C			
2	1.5	M1220C	I55AP215D00701K03S	M1420C	I55AP215F00711K03S
		M3220C		M3420C	
3	2.2	M1230C	I55AP222D00701K03S	M1430C	I55AP222F00711K03S
		M3230C		M3430C	

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MC to i5x0 protec cross substitution part numbers

NEMA 4X - STAINLESS STEEL (POLYCARBONATE ENCLOSURE ONLY - NO STAINLESS STEEL OPTION)					
Input Line Voltage		120V or 240V (1Ø)		208-240V (1Ø)	
hp	kW	MC Series	i5x0 protec (120V ONLY)	MC Series	i5x0 protec
0.25	0.18	M1103SE	I55AP137A00701K03S		
		M3103SE			
0.5	0.37	M1105SE	I55AP137A00701K03S	M1205SE	I55AP137D00701K03S
		M3105SE		M3205SE	
1	0.75	M1110SE	I55AP175A00701K03S	M1210SE	I55AP175D00701K03S
		M3110SE		M3210SE	
1.5	1.1	M1115SE	I55AP211A00701K03S	M1215SE	I55AP211D00701K03S
		M3115SE		M3215SE	
2	1.5			M1220SE	I55AP215D00701K03S
				M3220SE	
3	2.2			M1230SE	I55AP222D00701K03S
				M3230SE	

NEMA 4X - STAINLESS STEEL (POLYCARBONATE ENCLOSURE ONLY - NO STAINLESS STEEL OPTION)					
Input Line Voltage		208-240V (3Ø)		400-480V (3Ø)	
hp	kW	MC Series	i5x0 protec	MC Series	i5x0 protec
0.5	0.37	M1205E	I55AP137D00701K03S		
		M3205E			
1	0.75	M1210E	I55AP175D00701K03S	M1410E	I55AP175F00711K03S
		M3210E		M3410E	
1.5	1.1	M1215E	I55AP211D00701K03S		
		M3215E			
2	1.5	M1220E	I55AP215D00701K03S	M1420E	I55AP215F00711K03S
		M3220E		M3420E	
3	2.2	M1230E	I55AP222D00701K03S	M1430E	I55AP222F00711K03S
		M3230E		M3430E	

Notes:
120VAC single phase input produces 230VAC three phase output.
IP66 protec is ONLY available in Polycarbonate enclosures. THERE IS NO STAINLESS STEEL OPTION.

4 Mechanical installation

4.1 General fit

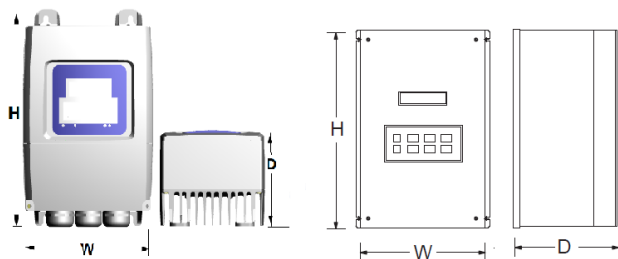| Mechanical	MC NEMA 4,4X,12	i550 IP66,IP54
Enclosure protection class	NEMA 4,4X,12	IP55, IP54 (equivalent to NEMA 4X and NEMA 12)
Built-in heatsink	Yes	Yes
Cold plate	No	C-type possible
Zero-clearance side-by-side mounting	No	Yes

Notes:
1. Enclosure Material is different. MC NEMA 4 are in painted steel enclosures. MC NEMA 4X are in Stainless Steel Enclosures. IP66 i550 protec are in Polycarbonate enclosures.
2. Size: The i510/i550 protec is similar in size to the MC. See dimensional comparison on next page:

V	kW	Internal EMC Filter	i550 IP66 protec			MC IP65/ IP54 Dimensions		
			H	W	D	H	W	D
120 V 1-p	0.37	no	190	140	117	200.2	199.6	95.3
120 V 1-p	0.75	no	190	140	117	200.2	199.6	124.5
120 V 1-p	1.1	no	205	140	140	200.2	199.6	124.5
230 V 1-p	0.37	yes	190	140	117	200.2	155.4	110.5
230 V 1-p	0.55	yes	190	140	117			
230 V 1-p	0.75	yes	190	140	117	200.2	155.4	110.5
230 V 1-p	1.1	yes	205	140	140	200.2	199.6	124.5
230 V 1-p	1.5	yes	205	140	140	200.2	199.6	124.5
230 V 1-p	2.2	yes	205	140	140	200.2	199.6	149.9
230V 1/3-p	0.37	no	190	140	117	200.2	155.4	110.5
230V 1/3-p	0.55	no	190	140	117			
230V 1/3-p	0.75	no	190	140	117	200.2	155.4	110.5
230V 1/3-p	1.1	no	205	140	140	200.2	155.4	133.4
230V 1/3-p	1.5	no	205	140	140	200.2	199.6	124.5
230V 1/3-p	2.2	no	205	140	140	200.2	199.6	149.9
230V 3-p	3	no	250	180	170			
230V 3-p	4	no	250	180	170	247.7	260.6	182.9
230V 3-p	5.5	no	250	180	170	298.5	260.6	212.1
230V 3-p	7.5	no	290	180	170	349.3	260.6	212.1
230V 3-p	11	no	290	180	170	400.1	260.6	212.1
230V 3-p	15	no	405	220	184	400.1	260.6	212.1
230V 3-p	18.5	no	405	220	184	514.4	260.6	212.1
400/480 V 3-p	0.75	yes (i510 no)	190	140	117	200.2	155.4	110.5
400/480 V 3-p	1.1	yes (i510 no)	205	140	140			
400/480 V 3-p	1.5	yes (i510 no)	205	140	140	200.2	199.6	124.5
400/480 V 3-p	2.2	yes (i510 no)	205	140	140	200.2	199.6	124.5
400/480 V 3-p	3	yes (i510 no)	250	180	170			
400/480 V 3-p	4	yes (i510 no)	250	180	170	200.2	199.6	149.9
400/480 V 3-p	5.5	yes (i510 no)	250	180	170	247.7	260.6	182.9
400/480 V 3-p	7.5	yes (i510 no)	290	180	170	298.5	260.6	212.1
400/480 V 3-p	11	yes (i510 no)	290	180	170	336.6	260.6	212.1
400/480 V 3-p	15	yes	405	220	184	400.1	260.6	212.1
400/480 V 3-p	18.5	yes	405	220	184	400.1	260.6	212.1
400/480 V 3-p	22	yes	405	220	184	400.1	260.6	212.1
400/480 V 3-p	30	yes	870	300	290	514.4	260.6	212.1
400/480 V 3-p	37.5	yes	870	300	290	533.4	348.5	212.1
400/480 V 3-p	45	yes	870	300	290	533.4	348.5	212.1
400/480 V 3-p	55	yes	870	300	290	939.8	457.2	337.8
400/480 V 3-p	75	yes	870	300	290	990.6	660.4	337.8
400/480 V 3-p	90	yes	1200	320	320	990.6	660.4	337.8
400/480 V 3-p	110	yes	1200	320	320			

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4.2   Engineering

1. Mounting:
    MC has different mounting hole locations than i550 protec. New mounting holes will need to be drilled.
2. Zero clearance:
    i550 protec can be mounted side-by-side with zero clearance without derating. This was not possible with MC.

5   Main electrical installation

5.1   General fit

Electrical	MC	i550
Supported network	TT, TN	TT, TN (IT only as C-type)
Integrated dynamic brake transistor	Option	Yes
DC Interconnection 400/480V-3ph:	-	Yes

5.2   Engineering

1. Unlike i500 cabinet drives, i500 protec drives have integrated mains chokes on power sizes where required.
2. Connector position:
    Both the MC and i550 protec have all connections at the bottom of the inverter; however, Mains and Motor connections are reversed. On MC - Mains is on the Right. On i550protec - Mains is on the left. This is to be more intuitive for customers where we have seen a tendency for customers to miss-wire.

Control

6 Control

6.1 General fit

Device I/O	MC	i550 protec
		Standard I/O
Digital inputs	4 + 1 Start + 1 Stop	5
Digital outputs	2 (NPN, sinking)	1
Relay output	1 (NO/NC)	1 (NO/NC)
Analog inputs	1 (V or I)	1 (V/I) + 1 (V)
Analog outputs	2 (V) Not configurable	1 (V/I)
Frequency output	-	Yes
Logic	NPN	PNP or NPN
Encoder feedback	-	DI3 / DI4 up to 100kHz
Frequency input (Pulse train input)	-	DI3 / DI4
Internal 24V supply; 100mA	-	Yes
Input for external (keep alive)	-	Yes
Available with fieldbus	Modbus-RTU only	Yes

Device I/O	MC	i550 protec
Safe Torque Off STO	-	Optional
Integrated brake transistor	option	Yes (all sizes)
Dedicated PTC input	-	Yes

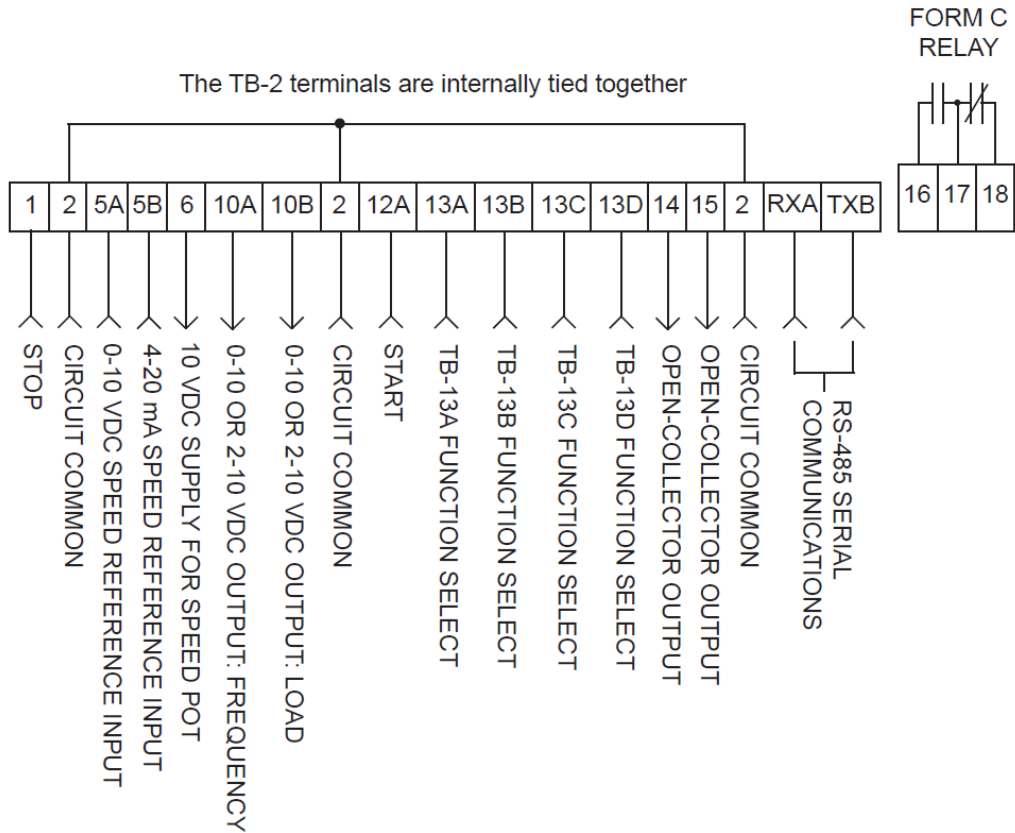| Control connectors	MC	i550 protec
AIO, DIO terminals	Fixed, Screw	Fixed, Spring
Relay terminals	Fixed, Screw	Fixed, Spring
STO terminals	-	Pluggable, Spring
PTC input	-	Fixed, Spring

6.2 Engineering notes

1. Stop Terminal:
   The Stop function (terminal # 1) and the Start function (terminal #12A) are dedicated digital inputs on MC. On i510/i550 every IO-function can be freely assigned in Parameter 400 (P400). The function Stop is assigned in P400:02. The Run function has several options for configuring (See P400:02 and P400:06-09).
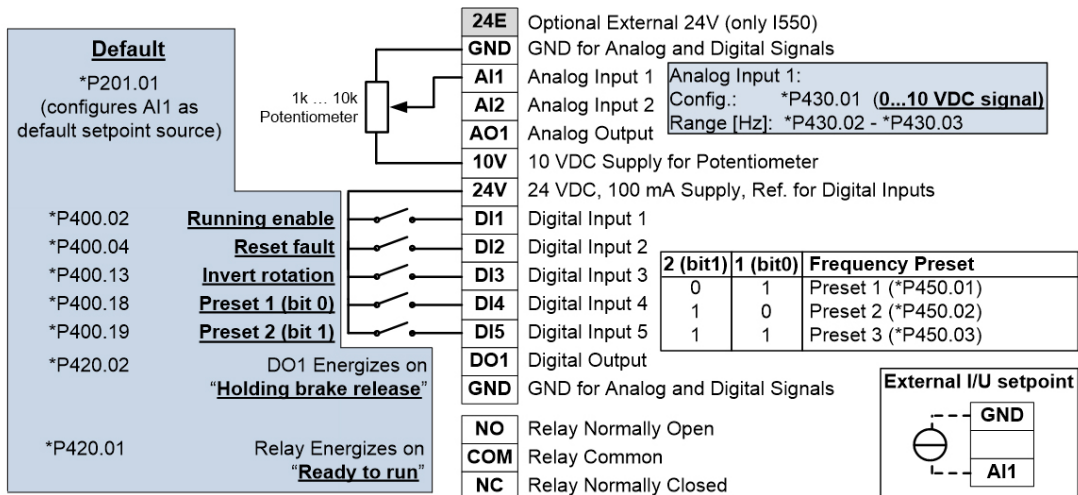
2. Control terminals Standard I/O:

MC:

FORM C RELAY

The TB-2 terminals are internally tied together

| 1 | 2 | 5A | 5B | 6 | 10A | 10B | 2 | 12A | 13A | 13B | 13C | 13D | 14 | 15 | 2 | RXA | TXB | 16 | 17 | 18 |

- STOP
- CIRCUIT COMMON
- 0-10 VDC SPEED REFERENCE INPUT
- 4-20 mA SPEED REFERENCE INPUT
- 10 VDC SUPPLY FOR SPEED POT
- 0-10 OR 2-10 VDC OUTPUT: FREQUENCY
- 0-10 OR 2-10 VDC OUTPUT: LOAD
- CIRCUIT COMMON
- START
- TB-13A FUNCTION SELECT
- TB-13B FUNCTION SELECT
- TB-13C FUNCTION SELECT
- TB-13D FUNCTION SELECT
- OPEN-COLLECTOR OUTPUT
- OPEN-COLLECTOR OUTPUT
- CIRCUIT COMMON
- RS-485 SERIAL COMMUNICATIONS

i500:

24E	Optional External 24V (only I550)
GND	GND for Analog and Digital Signals
AI1	Analog Input 1
AI2	Analog Input 2
AO1	Analog Output
10V	10 VDC Supply for Potentiometer
24V	24 VDC, 100 mA Supply, Ref. for Digital Inputs
DI1	Digital Input 1
DI2	Digital Input 2
DI3	Digital Input 3
DI4	Digital Input 4
DI5	Digital Input 5
DO1	Digital Output
GND	GND for Analog and Digital Signals
NO	Relay Normally Open
COM	Relay Common
NC	Relay Normally Closed

Default

*P201.01 (configures AI1 as default setpoint source)

1k … 10k Potentiometer

Analog Input 1:
Config.:   *P430.01 (0...10 VDC signal)
Range [Hz]: *P430.02 - *P430.03

*P400.02	**Running enable**
*P400.04	**Reset fault**
*P400.13	**Invert rotation**
*P400.18	**Preset 1 (bit 0)**
*P400.19	**Preset 2 (bit 1)**
*P420.02	DO1 Energizes on "**Holding brake release**"
*P420.01	Relay Energizes on "**Ready to run**"

2 (bit1)	1 (bit0)	Frequency Preset
0	1	Preset 1 (*P450.01)
1	0	Preset 2 (*P450.02)
1	1	Preset 3 (*P450.03)

External I/U setpoint

	GND
	AI1

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I/O Point Comparison:

MC	Function	i500	Note:
1	DI - Dedicated Stop	DI1	P400.1: TRUE [1], P400.2: Digital Input 1 [11]
2	Circuit Common (Analog and Digital Common)	GND	Analog and Digital Common
5A	Analog input (Setpoint) 0...10 VDC	AI1	P430:1 (0...10 VDC; 4...20 mA Configurable)
5B	Analog input (Setpoint) 4...20 mA		
6	10VDC supply for speed pot	10V	10VDC supply for speed pot
10A	Analog Output: Frequency (0-10VDC or 2-10VDC)	AO1	Analog output Configurable P440:1, P440:2
10B	Analog Output: Load (0-10VDC or 2-10VDC)	-	AO2 only available on i550 Applciation I/O
13A	DI – P47 *(default not configured)*	DI2	P400:004 (default config. – Reset Fault)
13B	DI – P48 *(default not configured)*	DI3	P400:013 (default config. – Invert rotation)
13C	DI – P49 *(default not configured)*	DI4	P400:018 (default config. – Preset Setpoint bit 0)
13D	DI – P50 *(default not configured)*	DI5	P400:019 (default config. – Preset Setpoint bit 1)
14	DO (Sinking) P52 *(default not configured)*	DO1	PNP +24 VDC, , P420.2 (default – Release Brake)
15	DO (Sinking) P53 *(default not configured)*	-	DO2 only available on i550 Applciation I/O
TXA	Modbus TXB	CH/TB	Modbus Variant Required
TXB	Modbus TXA	CL/TA	Modbus Variant Required
-	-	24V	+24 VDC, 100 mA
16	Relay NO P54 *(default not configured)*	NO	Form C relay (NO, NO, COM)
17	Relay COM	NC	
18	Relay NC NO P54 *(default not configured)*	COM	P420.1: Fault [56]

Important notes:
- The Digital Outputs on MC (terminals 14 and 15) are Open Collector / Sinking type output. The i550 Digital Outputs are PNP / Sourcing +24 VDC.
- i550 uses 24V as reference for DI when active high or GND as reference when active low.

7 Communication

7.1 General fit

Communication (option)	MC	i550 protec
CANopen	-	Yes
PROFIBUS	-	Yes
ETHERNET Powerlink	-	Yes
Modbus	Standard	Yes
EtherCat	-	Yes
ProfiNet	-	Yes
Ethernet IP	-	Yes
Connector Type	Fixed, Screw	Fixed, Spring
Combination Fieldbus & Keypad possible?	Yes	Fixed, Spring (Modbus/CANopen, Profibus) Dual RJ-45 (all EtherNET busses)
Fieldbus combination with I/O possible?	Yes	Yes

7.2 Engineering

1. Control words and register addresses:
   The fieldbus control words and the register addresses have changed. Refer to the communication manual for detailed information.
2. Modbus:
   i550 protec: Modbus variants are dedicated type codes.

8 Functionality

8.1 General fit

Motor	MC	i550 protec
Asynchronous induction motor control	Yes	Yes
Synchronous motor control	-	Yes
Max Output frequency	590 Hz (**NOTE HISTORICALLY COULD BE UNLOCKED UP TO 650Hz**)	599 Hz (>599Hz --> C-Type)

Motor control	MC	i550 protec
VFCplus: V/f linear	Yes	Yes
VFCplus: V/f squared	Yes	Yes
VFCplus: V/f linear closed loop with encoder	-	Yes
VFCplus: V/f squared closed loop with encoder	-	Yes
VFCplus: V/f user definable V/f characteristic	-	Yes
VFCplus Eco (Energy saving feature)	-	Yes
Voltadd control (Additive voltage impression)	-	Yes
SLVC: Sensorless vector control ASM	-	Yes – Speed & Torque
SLPSM: Sensorless vector control PSM	-	Yes
SC: Servo Control for synchr. motors (SM)	-	-
SC: Servo Control for asnchr. motors (ASM)	-	Yes

Functions	MC	i550 protec
Process controller (PID)	Yes	Yes
Motor potentiometer	Yes	Yes
Fixed setpoints for speed /accel / decel	4 / 1 / 1	15 / 2 / 2
Slip compensation	Yes	Yes
Skip frequency	2 frequency ranges	3 frequency ranges
Motor brake (holding brake) control	-	Yes
Speed control with torque limitation	-	Yes
Flying start	Yes	Yes
Parameter change over	-	4x32 parameter
Sequencer	-	Yes (flat, but also nested sequences possible)
Automatic Start	Yes	Yes
DC brake	Yes (0 Hz, auto only)	Yes (programmable Hz trigger auto and manual trigger)
AC motor brake	-	Yes
Controlled deceleration during undervoltage	-	Yes
Frequency (Pulse-Train) setpoint	-	Yes
Support of user units	Hz Multiplier, PID Units	Hz Multiplier, PID Units
Switch Off Positioning	-	Yes

9 Operation / Commissioning

9.1 General fit

Operation	MC	i550 protec
Program without mains power?	-	Yes (USB, memory module, +24 VDC [i550])
Keypad	Integrated	Optional
Descriptive text on keypad	Yes	Yes
PC tool	TechLink	EasyStarter, Smart Keypad
Interface	LCD Text Keypad	LCD Text Keypad, USB-Module, WLAN-Module ***(i550 protec has USB integrated)**
Removable memory module	No	Yes

9.2 Engineering

1. New parameter numbers:
   The parameters for the i500 have been arranged for better usability. Due to this, the parameter numbers are not equal and can't be copied 1:1.
2. Common parameters:
   Parameter numbers have changed. The following list shows the most common used parameters:

MC NEMA 1 / IP31		i550		
Param. #	Param. Name	Param. #	Param. Name	Param. Group
P30	CONTROL	P200:00	Control Selection	Group 2: Basic Settings
P29	MANUAL	P201:01	Frequency Setpoint Source	
P10	MIN FRQ	P210:00	Minimum motor frequency	
P11	MAX FRQ	P211:00	Maximum motor frequency	
P8	ACCEL	P220:00	Acceleration time 1	
P9	DECEL	P221:00	Deceleration time 1	
P0	LINE VOLTS	P208:01	Rated Mains Voltage	
P18	BASE	P303.02	V/f Base Frequency	Group 3: Motor Control
P19	FX BOOST	P316.01	Fixed voltage boost	
P47	TB13A	P400.02	Run / Stop	Group 4: Function & I/O Settings
P48	TB13B	P400.04	Reset Fault	
P49	TB13C	P400.13	Invert Rotation Direction	
P1	SPEED #1	P450.01	Preset frequency setpoint 1	
P2	SPEED #2	P450.02	Preset frequency setpoint 2	
P3	SPEED #3	P450.03	Preset frequency setpoint 3	
P54	RELAY	P420.01	Relay function	
P42	TB14 OUT	P420.02	DO1 function	
		Favorites		

- Please note that the most commonly used MC parameters can be found in the preconfigured Favorites Menu (Group 0) of i500.
- In addition – the Favorites Menu contents in i500 can be customized by the OEM / machine builder.
- Please note in MC changes to parameters were automatically saved. In i500 the user must execute a SAVE command to have changes be written to the EPM. A SAVE command can be executed either via the SAVE icon in EasyStarter or by pressing and holding the drive's enter key on the keypad for three seconds. This is also true for keypad speed setpoint.

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