ECA500-II

TOTAL MOTOR PROTECTION RELAY

Rated Voltage, Ue	208/220/240	440/480	VAC
Voltage Operation Limits, Ue	145➤312	264➤672	VAC

INSTALLATION INSTRUCTIONS

1 ECA500-11 GENERAL DESCRIPTION

ECA500-11 is an electronic **Total Motor Protection Relay** that constantly supervises the Motor Current and the main electrical parameters such as Voltage, Power Factor, Real power, Reactive power and Energy consumption, giving the most reliable protection against Overload, Phase failure, Phase reversal, Single phasing and Unbalanced conditions.

Only qualified electrical technicians with knowledge of overload relays and associated machinery should perform the installation, starting up, and maintenance of the system. Adhere to all local and national electric codes. Disconnect all electrical power at the source prior to any installation or maintenance work. Failure to comply could result in equipment damage, personal injury, OR even death.
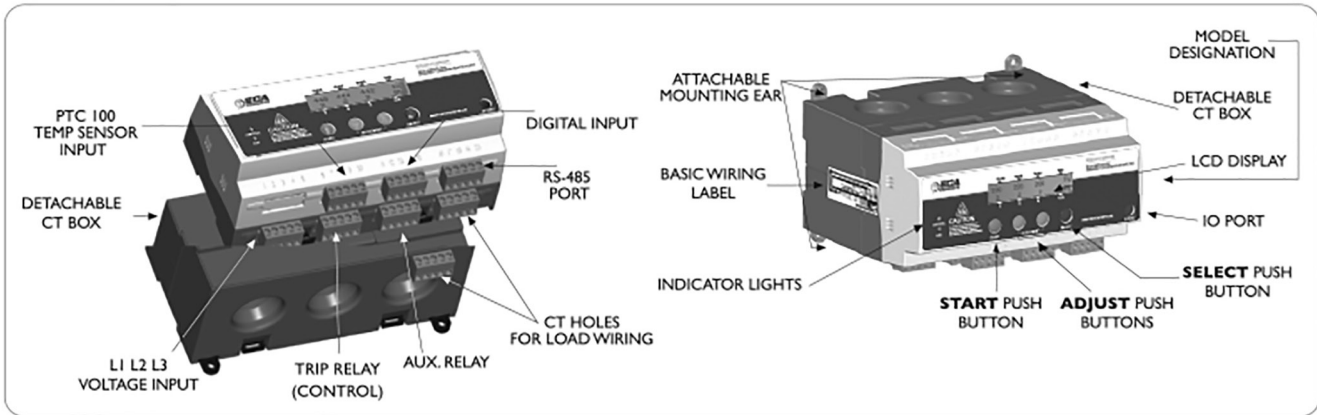
WARNING: This product may start automatically, the user must take caution to avoid hazards to people.

CAUTION: This product has been designed for industrial environment. Use of this product in residential enviroment may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.
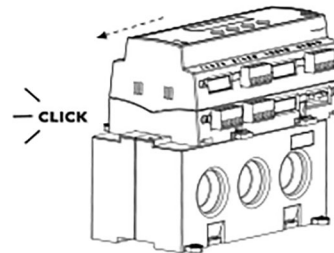
CAUTION: An incorrectly applied or installed **ECA500-11** can result in damage to the components or reduction in product life. Wiring or application errors, or operating/ storing in excessive ambient temperatures may result in malfunction of the **ECA500-11**.

2 PARTS AND PIECES

- PTC 100 TEMP SENSOR INPUT
- DETACHABLE CT BOX
- L1 L2 L3 VOLTAGE INPUT
- TRIP RELAY (CONTROL)
- AUX. RELAY
- CT HOLES FOR LOAD WIRING
- DIGITAL INPUT
- RS-485 PORT
- ATTACHABLE MOUNTING EAR
- BASIC WIRING LABEL
- INDICATOR LIGHTS
- MODEL DESIGNATION
- DETACHABLE CT BOX
- LCD DISPLAY
- IO PORT
- **SELECT** PUSH BUTTON
- **ADJUST** PUSH BUTTONS
- **START** PUSH BUTTON

3 ECA500-11 DETACHABLE CT BOX MOUNTING

CAUTION: Each set of **ECA500-11** and detachable CT box is calibrated and have the same Model Number. Before assembling the CT box verify that its factory number is the same than **ECA500-11** one. Failure to comply may result in a measurement error and a loss of protection.

3.1 Instructions for ECA500-11 CT BOX assembly

a) Move the supporting brackets 2mm outside and push downward **ECA500-11** to CT BOX until back groove of relay can insert into CT BOX guide rail, using Alignment Mark as reference:
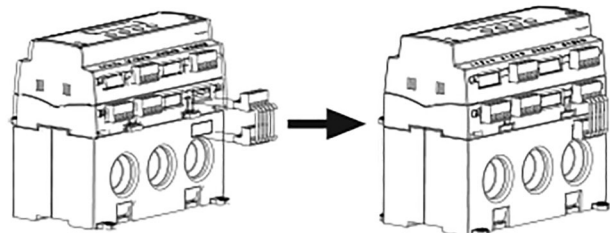

b) From Alignment Mark, move **ECA500-11** relay towards, the left sliding through rail guide until it does Click, as shown in following picture:
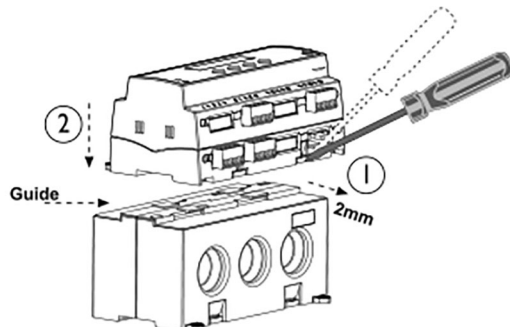
c) Insert both CT Input Terminals connecting **ECA500-11** and CT Box.
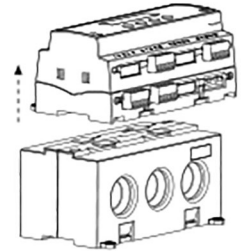
3.2 Instructions for ECA500-11 - CT BOX dismounting

a) Disconnect both CT Input Terminal used for **ECA500-11** and CT Box connection and pull down both supporting brackets by means of screwdrivers (see figure):
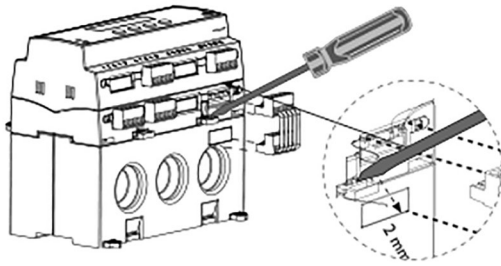
b) Move **ECA500-11** towards the right sliding through CT Box guide rail until it gets to alignment mark.
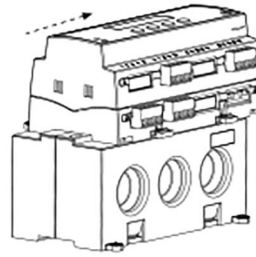
c) Pull Out **ECA500-11** upwards from CT Box

④ ECA500-11 **DIN RAIL MOUNTING**

⚠ **CAUTION: ECA500-11** must be installed in an accessible position free from dust, dirt, dampness and vibration. Allow enough space for air circulation around the enclosure and easy access to all operator controls. Indoor use only.

4.1 Instructions for Mechanical Installation without CT Box

a) Place **ECA500-11** at inclined position and its back side must be placed toward the upper edge of the DIN Rail and then push down **ECA500-11** relay as shown in figure until it CLICKS on the rail as shown in figures:

DIN Rail →
— CLICK
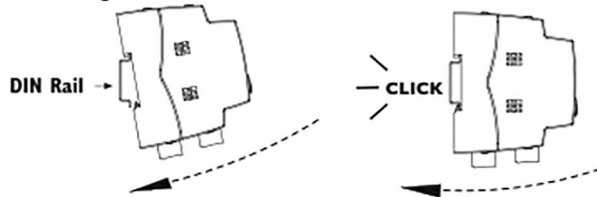
4.2 Instructions for Mechanical Installation with CT Box

Once you have assembled CT Box on **ECA500-11** (See item 3.1) you shall follow these mounting instructions:

a) Place **ECA500-11** at inclined position so that its back side (CT Box) must be placed toward the upper edge of the DIN Rail and then push down **ECA500-11** relay as shown in figure until it does CLICK on the rail.

DIN Rail →
— CLICK
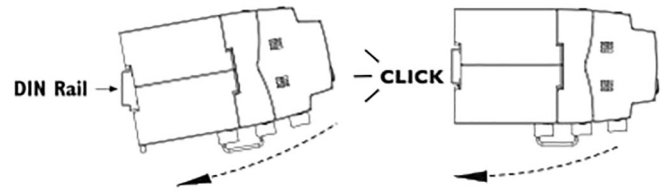
⑤ ECA500-11 **FLAT SURFACE MOUNTING**

5.1 Instructions for Mechanical Installation without CT Box

a) Take off the four (4) mounting ears at back side of **ECA500-11**, insert and slip both mounting ears into the **ECA500-11** back side grooves.
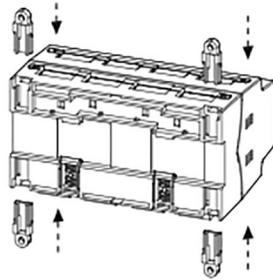
b) Place **ECA500-II** over a flat surface panel and mount it using(2) #8 x 1/2" screws
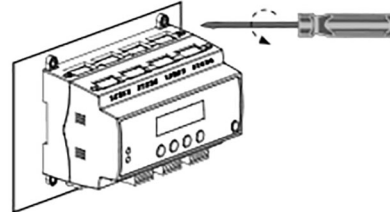
Recommendation for Flat Surface Mounting:
Make four (4) hole (5/32") on panel surface before installing. Refer Section 6.2 for dimensions.

5.2 Instructions for Mechanical Installation with CT BOX

Once you have assembled Detachable CT Box on ECA500-11 (Item 3.1)
a) Take off the four (4) mountings ear at back side of CT Box. Insert and slip both mounting ears into the CT Box back side grooves.
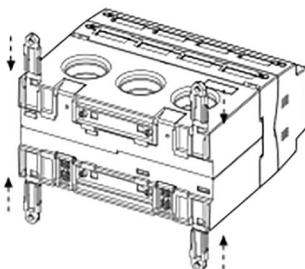
b) Place **ECA500-II** over a flat surface panel and mount it using(2) #8 x 1/2" screws
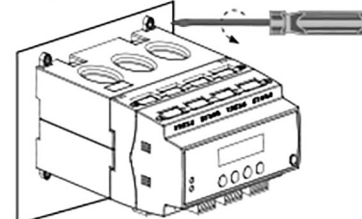
Recommendation for Flat Surface Mounting:
Make four (4) hole (5/32") on panel surface before installing. Refer Section 6.2 for dimensions.

6 ECA500-11 GENERAL DIMENSIONS

194.5 mm
157.8 mm
175 mm
90 mm
106.8 mm
Ø 18
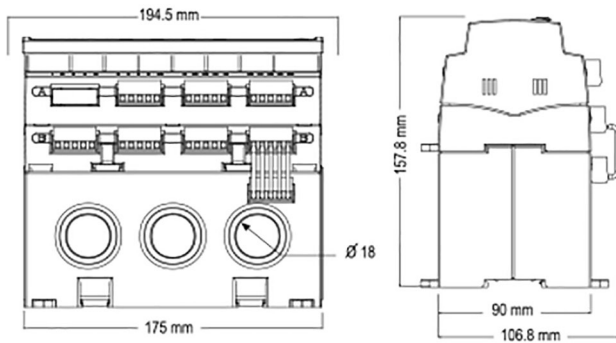
6.1 Guide for Flat Surface with CT Box

Ø 5/32"
100mm
152mm
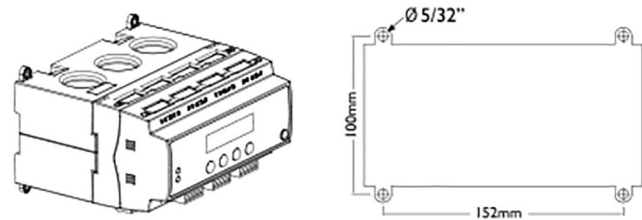
6.2 Guide for Flat Surface without CT Box

Ø 5/32"
100mm
152mm
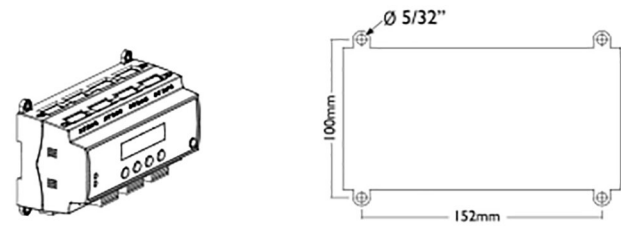
7 ECA500-11 CONNECTION DIAGRAM

⚡ **WARNING:** Disconnect power supply before installing **ECA500-11**. Failure to comply may result in death or serious injury.

⚠️ **CAUTION:** Check that the voltage and current chosen of **ECA500-11** model corresponds to line voltage and motor current.

7.1 Wiring Diagram
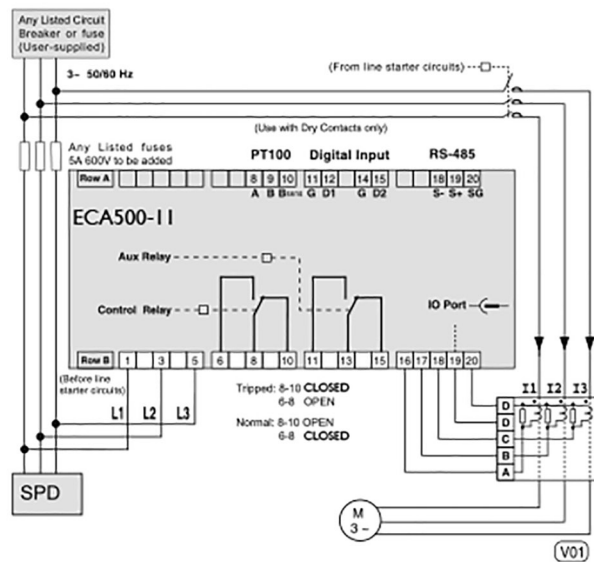
(*) REQUIREMENTS FOR SURGE PROTECTIVE DEVICE, (user-supplied)

- UL Recoggnized SPD Type 2
- Wiring configuration   3-phase (DELTA or WYE or arrangement of 3 x 1-Ph)
- AC Power Frequency: 50 or 60 Hz.
- Voltage Protection Rating (VPR):   ≤ 1800V
- Nominal Discharge Current (In)   ≥ 10 kA
- Max. Continuous Voltage (MCOV)   Any value between 1.1 and 1.4 U_e, where U_e is the nominal voltage of the installation
- Short-circuit current rating (SCCR)   10 kA min

CAUTION: In case of wiring configuration with Ungrounded power, take into account that Ungrounded systems are inheretly unstable and can produce excessively high line-to-ground voltages during fault conditions. During these fault conditions any electrical equipment, including an SPD, may be subjected to voltages which exceed their designated ratings. This information is being proviyed to the user so that an informed decision can me made before installing any electrical equipment on an ungrounded power system

7.2 Terminal designation

TERMINAL	DESCRIPCIÓN
B1	Voltage Input **L1** (Phase **R**)
B3	Voltage Input **L2** (Phase **S**)
B5	Voltage Input **L3** (Phase **T**)
B6	Control Relay (Closed when normal)
B8	Control Relay (common)
B10	Control Relay (Closed when tripped)
B11	Auxiliary Relay (Closed when normally)
B13	Auxiliary Relay (common)
B15	Auxiliary Relay (Closed when tripped)
B16	CT-A Input
B17	CT-B Input
B18	CT-C Input
B19-B20	CT-D (Common secondary)
A8-A9-A10	PT100 (Terminal A-B-B Sensor).
A11-A12	Digital Input 1 (Dry Contacts only)
A14-A15	Digital Input 2 (Dry Contacts only)
A18	RS485 S- (Negative Serial Comm)
A19	RS485 S+ (Positive Serial Comm)
A20	RS485 SG (**Ground for** Serial Comm)

Recommendation for Wiring

- Avoid over tightening M2.5 screws terminals during wiring connection. Torque max: 4.5 lb-in (5.18 kgf-cm).
- Feed the three phases going to the motor through the three holes. Using less than three wires may cause mon-desired current unbalance.
- Screw Terminal wire size: Between 12 AWG and 18 AWG.

- Maximum diameter of CT Box Holes wiring size: AWG 0 (18 mm).
- Connect L1L2L3 terminal for Voltage Input in parallel connection before line starter circuit before line starter circuit contactor (as shown in Diagram Connection).
- Wire Strip Length: 7-8 mm.

8 ECA500-11 OPERATION

ECA500-11 constantly supervises current and voltage values; when any harmful condition occurs, the output connection is deactivated until the fault disappears and power line conditions returns to an acceptable level. Specific timing such as Start Up Delay and Fault Detection Delay are incorporated to prevent nuisance tripping due to rapid power fluctuations.

ECA500-11 provides LCD Display to indicate the output status (voltage, current, unbalance, frequency and load status). Also provides four (4) push buttons (ON/Off, Up, Down and Select) for electrical parameter adjustment such as Voltage, Current, Frequency, Fault Detection Delay and others. Besides these mentioned advantages, a Communication Port with MODBUS RTU protocol is included in **ECA500-11**.

9 ECA500-11 SETUP MENU & NAVIGATION

Pantallas de Estado del Relé

1.1 Disconnected by MODBUS
```
220   220   200   7%
      OFF MODBUS
```

1.2 Disconnected by off scheduling timer
```
220   220   200   7%
OFF  SCHEDL  TIMER
```

1.3 Disconnected on MANUAL Mode
```
220   220   200   7%
      OFF MANUAL
```

1.4 Disconnected by 3rd. Failure
```
220   220   200   7%
OFF    3RD   FAILS
```

1.5 Start Up Delay (TC)
```
220   220   200   7%
      START DELAY 15"
```

1.6 TC Because of Undercurrent
```
220   220   200   7%
     UC DELAY 100'
```

Pantallas de Fallas

1.7 Undervoltage (UV)
```
100   220   200   7%
      UV 100V  V12
```

1.8 Overvoltage (OV)
```
220   220   280   7%
      OV 280V  V31
```

1.9 Voltage Unbalance (VUB)
```
220   220   200   10%
      VUB    10%
```

1.10 Frequency Shift (FS)
```
220   220   200   7%
      FS 63.6Hz
```
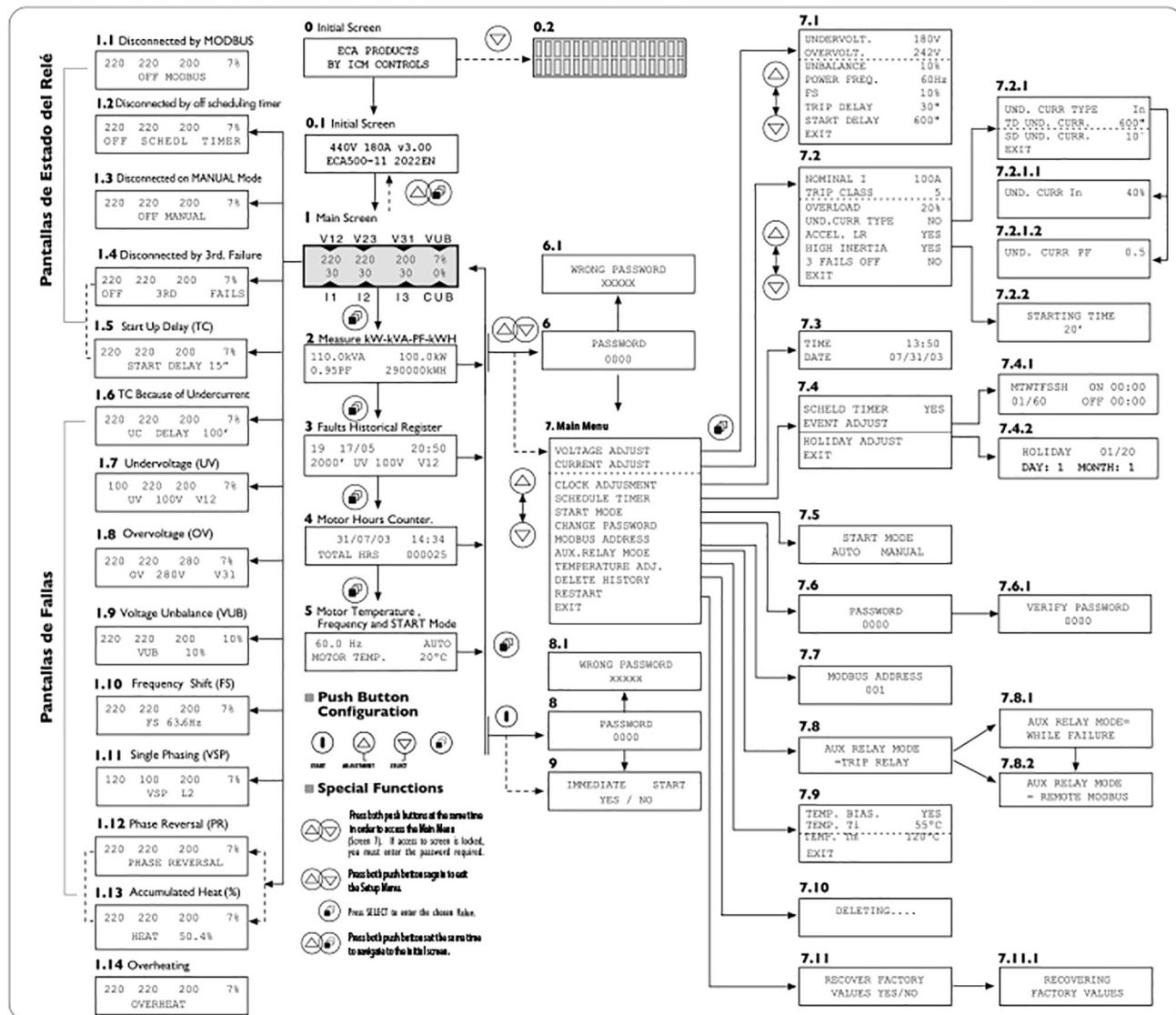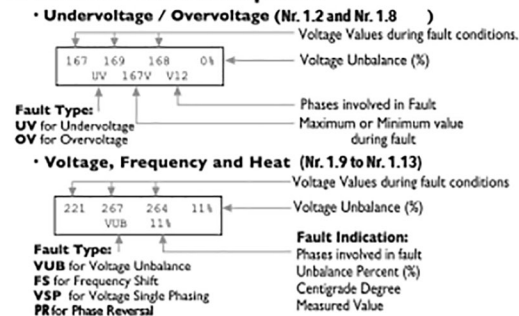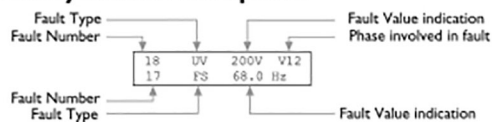
1.11 Single Phasing (VSP)
```
120   100   200   7%
      VSP  L2
```

1.12 Phase Reversal (PR)
```
220   220   200   7%
     PHASE REVERSAL
```

1.13 Accumulated Heat (%)
```
220   220   200   7%
      HEAT  50.4%
```

1.14 Overheating
```
220   220   200   7%
      OVERHEAT
```

0 Initial Screen
```
ECA PRODUCTS
BY ICM CONTROLS
```

0.1 Initial Screen
```
440V 180A v3.00
ECA500-11 2022EN
```

1 Main Screen
```
V12  V23  V31  VUB
220  220  200   7%
30   30    30   0%
I1   I2   I3  CUB
```

2 Measure kW-kVA-PF-kWH
```
110.0kVA    100.0kW
0.95PF    290000kWH
```

3 Faults Historical Register
```
19  17/05    20:50
2000' UV 100V  V12
```

4 Motor Hours Counter.
```
31/07/03    14:34
TOTAL HRS  000025
```

5 Motor Temperature , Frequency and START Mode
```
60.0 Hz         AUTO
MOTOR TEMP.    20°C
```

■ **Push Button Configuration**
(①) (△) (▽) (◉)
START ADJUSTMENT SELECT

■ **Special Functions**
(△▽) Press both push buttons at the same time in order to access the Main Menu (Screen 7). If access to screen is locked, you must enter the password required.

(△▽) Press both push buttons again to exit the Setup Menu.

(◉) Press SELECT to enter the chosen Value.

(△▽) Press both push buttons at the same time to navigate to the Initial screen.

0.2
```
▮▮▮▮▮▮▮▮▮▮▮▮
```

6.1
```
WRONG PASSWORD
XXXXX
```

6
```
PASSWORD
0000
```

7. Main Menu
```
VOLTAGE ADJUST
CURRENT ADJUST
CLOCK ADJUSMENT
SCHEDULE TIMER
START MODE
CHANGE PASSWORD
MODBUS ADDRESS
AUX.RELAY MODE
TEMPERATURE ADJ.
DELETE HISTORY
RESTART
EXIT
```

8.1
```
WRONG PASSWORD
XXXXX
```

8
```
PASSWORD
0000
```

9
```
IMMEDIATE  START
YES / NO
```

7.1
```
UNDERVOLT.     180V
OVERVOLT.      242V
UNBALANCE       10%
POWER FREQ.   60Hz
FS              10%
TRIP DELAY      30"
START DELAY    600"
EXIT
```

7.2
```
NOMINAL I      100A
TRIP CLASS       5
OVERLOAD        20%
UND.CURR TYPE   NO
ACCEL. LR      YES
HIGH INERTIA   YES
3 FAILS OFF     NO
EXIT
```

7.3
```
TIME          13:50
DATE      07/31/03
```

7.4
```
SCHELD TIMER    YES
EVENT ADJUST
HOLIDAY ADJUST
EXIT
```

7.5
```
START MODE
AUTO   MANUAL
```

7.6
```
PASSWORD
0000
```

7.7
```
MODBUS ADDRESS
001
```

7.8
```
AUX RELAY MODE
=TRIP RELAY
```

7.9
```
TEMP. BIAS.     YES
TEMP. T1       55°C
TEMP. TM      120°C
EXIT
```

7.10
```
DELETING....
```

7.11
```
RECOVER FACTORY
VALUES YES/NO
```

7.2.1
```
UND. CURR TYPE   In
TD UND.CURR.    600"
SD UND. CURR.    10"
EXIT
```

7.2.1.1
```
UND. CURR In    40%
```

7.2.1.2
```
UND. CURR PF    0.5
```

7.2.2
```
STARTING TIME
20"
```

7.4.1
```
MTWTFSSH   ON 00:00
01/60      OFF 00:00
```

7.4.2
```
HOLIDAY    01/20
DAY: 1  MONTH: 1
```

7.6.1
```
VERIFY PASSWORD
0000
```

7.8.1
```
AUX RELAY MODE=
WHILE FAILURE
```

7.8.2
```
AUX RELAY MODE
= REMOTE MODBUS
```

7.11.1
```
RECOVERING
FACTORY VALUES
```

■ **Fault Screen Description:**

· **Undervoltage / Overvoltage (Nr. 1.2 and Nr. 1.8)**

```
167   169   168   0%
      UV  167V  V12
```
— Voltage Values during fault conditions.
— Voltage Unbalance (%)
— Phases involved in Fault
— Maximum or Minimum value during fault

Fault Type:
UV for Undervoltage
OV for Overvoltage

· **Voltage, Frequency and Heat (Nr. 1.9 to Nr. 1.13)**

```
221   267   264   11%
      VUB   11%
```
— Voltage Values during fault conditions
— Voltage Unbalance (%)

Fault Type:
VUB for Voltage Unbalance
FS for Frequency Shift
VSP for Voltage Single Phasing
PR for Phase Reversal

Fault Indication:
Phases involved in fault
Unbalance Percent (%)
Centigrade Degree
Measured Value

■ **Fault History Screen Description:**

Fault Type — — — Fault Value indication
Fault Number — — Phase involved in fault

```
18   UV   200V   V12
17   FS   68.0 Hz
```

Fault Number
Fault Type
— Fault Value indication

ABBREVIATIONS	
TEMP.	TEMPERATURE
OVERVOLT.	OVERVOLTAGE
UNDERVOLT.	UNDERVOLTAGE
UND.CURR	UNDERCURRENT
AUX.	AUXILIARY RELAY
ADJ.	ADJUST
HRS	HOURS

GLOSSARY			
OL	OVERLOAD	VUB	VOLTAGE UNBALANCE
UC	UNDERCURRENT	UV	UNDERVOLTAGE
CSP	CURRENT SINGLE PHASE	OV	OVERVOLTAGE
CUB	CURRENT UNBALANCE	V	VOLTAGE
I	CURRENT	FS	FREQUENCY SHIFT
PF	POWER FACTOR	PR	PHASE REVERSAL
TD	TRIP DELAY	VSP	VOLTAGE SINGLE PHASE
TC	START UP DELAY	LR	LOCKED ROTOR

9.1 ECA500-11 Recommended Values for adjustable parameters.

· **Undervoltage (UV) and Overvoltage (OV)**
Manufacturers usually offers motors with limited range of operation voltage inside of ±10% of nominal value.
Example: a protector installed for a motor of 220V should be adjusted in:
UV=220*90%=198V (Undervoltage)
OV=220*110%=242V (Overvoltage)

· **Voltage Unbalance**
According to NEMA MG1 standard, it is recommended that motors operate with an unbalance voltage less than 5%.

· **Overload (OL)**
The recommended value for the protection against the overload is inside the range of 110% to 120% of nominal current (In) or the current specified in the motor nameplate at maximum rated load (FLA).

IN = FLA motor nameplate
OL = Service factor motor nameplate

· **Underload by current (%In)**
The recommended threshold value to protect from an underload fault condition through current monitoring is 80% of the maximum rated load current (FLA) specified by the manufacturer.

· **Underload by Power Factor (PF)**
Indicator applicable to motors that are oversized contributing to loss in efficiencies or running at low load or without load (dry running)

Example: submersible pumps of gas stations, etc.

- To protect against low load or dry running through monitoring of power factor (PF), the ECA500-II is factory set to 0.5 (Although this protection setting can be configured for a value in the range 0.1 to 0.9 PF, it is recommended to set the threshold to above 0.3 PF).

• **Selection of the Thermal class of the motor**

Class 5 smaller motors with fast acceleration, requiring extremely fast tripping in the event of overload.

Class 10 (Fast) Motors used in compressor, refrigeration equipment, submersible pumps and motors of general purpose usually classified under IEC standard that reach continual operation in less than 4 seconds.

Class 15 Motors for specialized applications.

Class 20 (standard) Motors of general purpose qualified under NEMA standard.

Class 30 (slow) Industrial motors for high inertia loads with tripping time that exceeds 10 seconds."

9.2 ECA500-11Schedule Timer Adjustment Guide

ECA500-11include "CLOCK ADJUSTMENTS" and "SCHEDULE TIMER" options. Following are examples considering EVENTS and HOLIDAYS adjustments.

EVENT 01 (example): From Tuesday to Saturday and Holiday ON:7:30 hrs - OFF: 16:45 hrs

HOLIDAY 01 (example) June 24 th

(*) If you require to adjust a new EVENT or HOLIDAY, press ▲ or ▼ to look for the number to assign and then press to enter it. It will take you to screen 7.4.1 (for Events) or 7.4.2 (for Holiday). Follow the indicated example steps shown above. If you want to exit, press ▲ or ▼ and you will go to screen 7.4.

⚡ **WARNING:** Disconnect power supply (Circuit Breaker OFF) and electrical wiring before dismounting **ECA500-11** Electrical shock will result in death or serious injury.

Recommendation for DIN Rail Mounting:
Pull downward 2 mm with a soft movement when using screwdriver for dismounting. Strong movement could break the supporting bracket.

10.1.1 DIN RAIL DISMOUNTING WITHOUT CT BOX

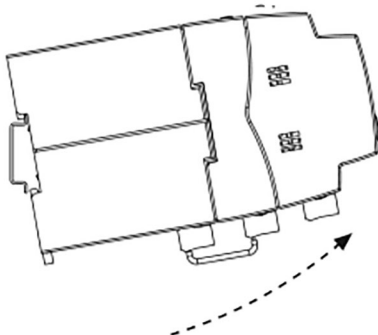a) Using a flat screwdriver, pull downward the mounting bracket that you can see at rear and down side of **ECA500-11** as shown in figure.
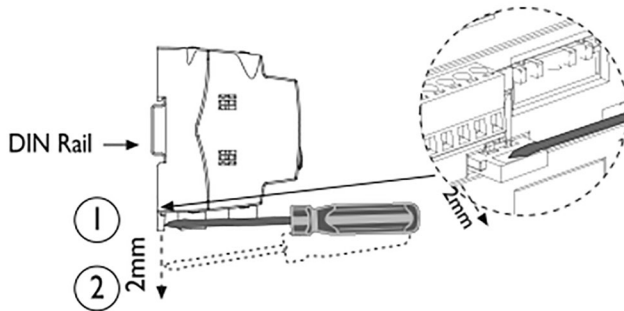
b) With screwdriver at position (2) pull out **ECA500-11** from DIN Rail as shown in figure.
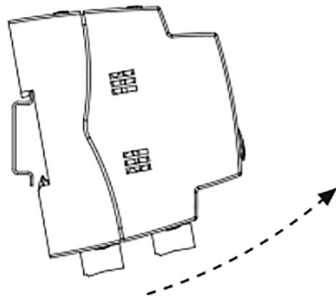
10.1.2 DIN RAIL DISMOUNTING WITH CT BOX

a) Using a flat screwdriver, pull downward the mounting bracket that you can see at rear and down side of **ECA500-11** as shown in figure.

b) With screwdriver at position (2) pull out **ECA500-11** from DIN Rail as shown in figure.

10.2.1 FLAT SURFACE DISMOUNTING WITHOUT CT BOX

a) Unscrew both screw fixed on Flat surface through attachable mounting ears and then pull out of **ECA500-11** relay from flat surface as shown in figure.
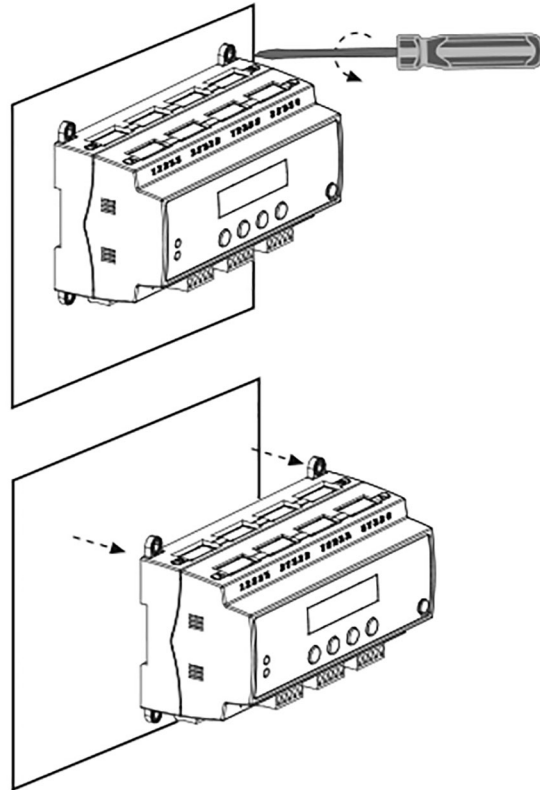
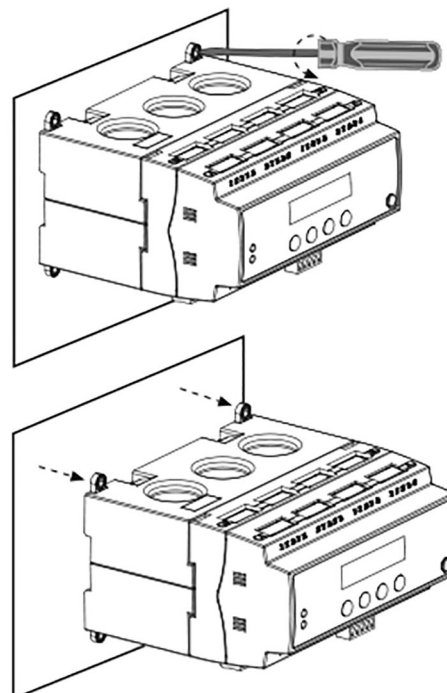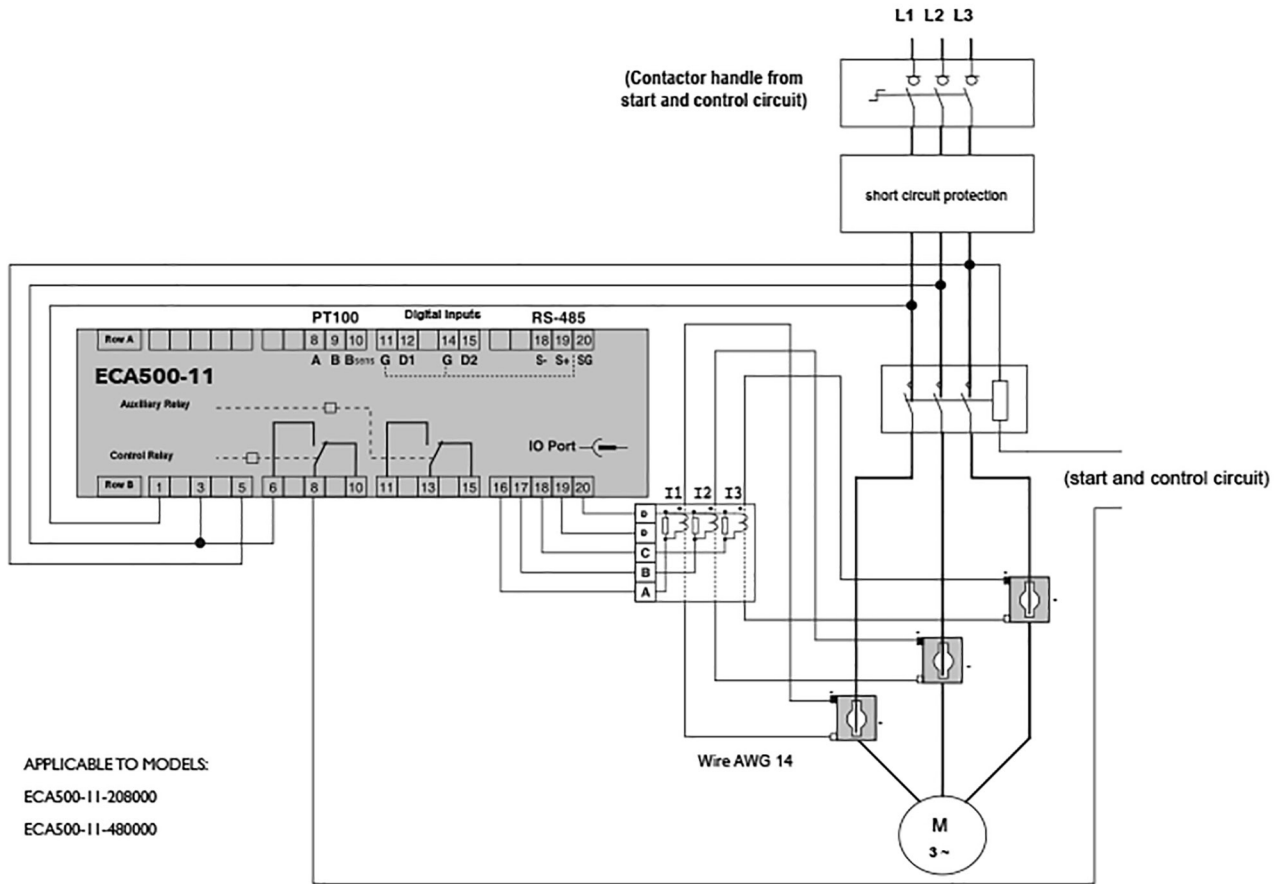## 10.2.2 FLAT SURFACE DISMOUNTING WITH CT BOX

a) Unscrew both screw fixed on Flat surface through attachable mounting ears and then pull out of **ECA500-11** relay from flat surface as shown in figure.

L1 L2 L3

(Contactor handle from start and control circuit)

short circuit protection

PT100   Digital Inputs   RS-485

| Row A | | | | | | 8 | 9 | 10 | 11 | 12 | 14 | 15 | | 18 | 19 | 20 |

A B B5015   G D1   G D2   S- S+ SG

ECA500-11

Auxiliary Relay

Control Relay

IO Port

| Row B | 1 | 3 | 5 | 6 | 8 | 10 | 11 | 13 | 15 | 16 | 17 | 18 | 19 | 20 |

I1 I2 I3

D
D
C
B
A

(start and control circuit)

Wire AWG 14

M
3 ~

APPLICABLE TO MODELS:

ECA500-11-208000

ECA500-11-480000

NOTES:

a) The models identified as ECA500-11-480000 and ECA500-11-208000 are used exclusively with externals CT. These models are to protect motors up to 660A nominal current.

b) The user must specify the nominal motor current. With this information, the user will select the nominal current range from the table and find the corresponding "/5" relation required in selecting the CT for installation.

c) The user must set up the **ECA500-11** with external CT using the instructions of adjustments contained in this application note. (All the others functions and protections will remain as specified in the installation's instruction **ECA500-11**).

d) The calibration of the **ECA500-11** will remain under warrantee, as long as the external CT are of commercial grade and rated Class I, secondary 5A.
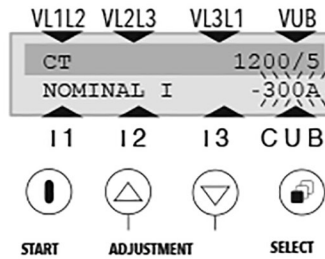
RECOMMENDED EXTERNAL CT RATIO ACCORDING TO NOMINAL CURRENT

Range of nominal current		Current transformers
Min.	Max.	Relation /5
150	200	600
190	250	750
200	260	800
250	330	1000
300 i.e. 350A	400	1200
375	500	1500
500	660	2000

Example: if a motor consume a nominal current of 350 amperes, the external toroids to select will be a value of 1200/5.
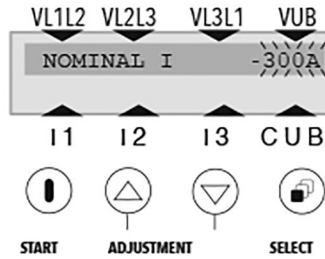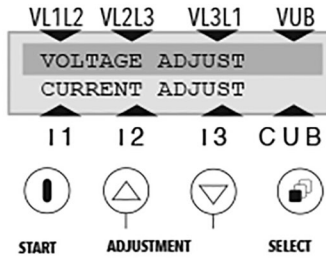
a) Press Up & Down combination buttons at the Home screen

```
   VL1L2  VL2L3  VL3L1   VUB
    220    220    220    7%
     2      2      2     0%
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```
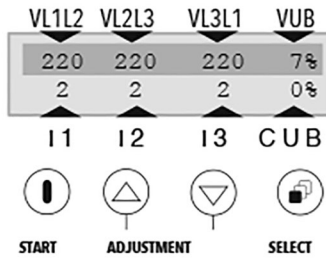
g) Press Up & Down combination to get to **NOMINAL I**

```
   VL1L2  VL2L3  VL3L1   VUB
   CT            1200/5
   NOMINAL I     -300A-
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

b) Press Up or Down to get to the **CURRENT ADJUST** screen

```
   VL1L2  VL2L3  VL3L1   VUB
   VOLTAGE ADJUST
   CURRENT ADJUST
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

h) Press SELECT to configure the **NOMINAL I** value

```
   VL1L2  VL2L3  VL3L1   VUB
   NOMINAL I     -300A-
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

c) In CURRENT ADJUST press **SELECT**

```
   VL1L2  VL2L3  VL3L1   VUB
   CURRENT ADJUST
   CLOCK ADJUST
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```
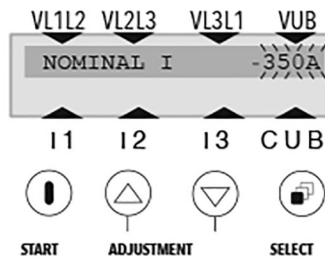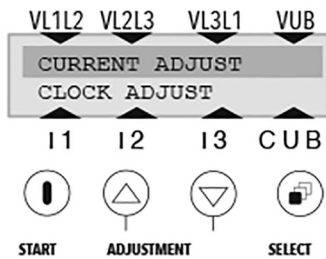
i) Press Up or DOWN to get to the desired value Ex: Change value from 300 to 350A

```
   VL1L2  VL2L3  VL3L1   VUB
   NOMINAL I     -350A-
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

d) In CT press the button SELECT

```
   VL1L2  VL2L3  VL3L1   VUB
   CT             800/5
   NOMINAL I       200A
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

j) Adjust the desire value pressing **SELECT**
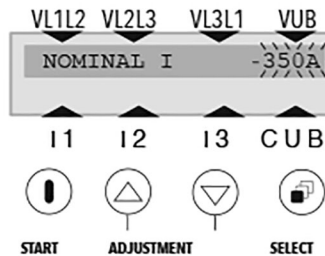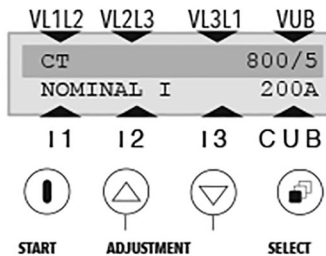
```
   VL1L2  VL2L3  VL3L1   VUB
   NOMINAL I     -350A-
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

e) In CT screen, press Up or Down to scroll to the required "/5" relation (refer table for Recommended External CT Ratio According Nominal Current).

Ex: For an engine with current FLA=350A change relation to 1200/5
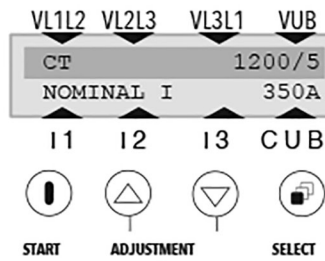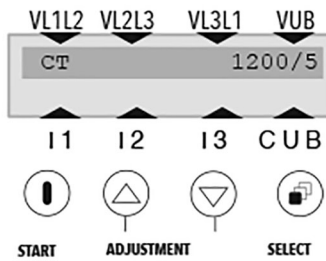
f) Press SELECT to set the required CT relation

```
   VL1L2  VL2L3  VL3L1   VUB
   CT            1200/5
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```

```
  START   ADJUSTMENT    SELECT
```

k) Return to Current Menu

```
   VL1L2  VL2L3  VL3L1   VUB
   CT            1200/5
   NOMINAL I       350A
    I1     I2     I3   CUB
  START   ADJUSTMENT    SELECT
```
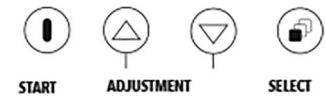
Continue with the other current adjustments or return to the MAIN MENU.

GROUP	REGISTER ADDRESS	NAME	READ/ WRITE	MIN	MAX	SIZE	UNITS	DESCRIPTION / FORMAT	FACTORY SETTING
PRODUCT ID	00000	PRODUCT_ID	R	12	12			F0	12
	00001	MODEL	R	162	252	1		F1	
	00002	VERSION	R	0	255	1		F2	
	00003	MODBUS_ADDRESS	R/W	1	127	1		F3	1
SECURITY	00004	ACCESS PASSWORD	R/W	0	65535	1		F4	0
SCHEDULE TIMER	00023	SCHEDULE TIMER	R/W	0	1	1		F7	0
ADJUSTMENTS	00024	ADDRESSES ARE RESERVED.							
	00025	(UV) UNDER VOLTAGE SETTING	R/W	95	460	1	VAC	F35	
	00026	(OV) OVER VOLTAGE SETTING	R/W	125	580	1	VAC	F36	
	00027	(VUB) VOLTAGE UNBALANCE SETTING	R/W	2	10	1	%	F7	6
	00028	AC POWER FREQUENCY SETTING	R/W	0	1	1		F42	1
	00029	(FS) FREQUENCY SHIFT SETTING	R/W	2	10	1	%	F7	2
	00030	(TD) TRIP DELAY SETTING	R/W	1	30	1	s	F7	10
	00031	(TC) START UP DELAY SETTING	R/W	0	600	1	s	F7	60
	00032	ADDRESSES ARE RESERVED.							
	00033	CT SETTING	R/W	0	8	1		F44	4
	00034	(FLA) NOMINAL CURRENT SETTING	R/W	15	180	1	AMP	F39	
	00035	MOTOR THERMAL CLASS SETTING	R/W	5	30	1		F7	5
	00036	(OL) OVERLOAD LEVEL SETTING	R/W	5	50	1	%	F7	10
	00037	UNDERCURRENT DETECTION	R/W	0	1	1		F52	0
	00038	HIGH-INERTIA LOAD DETECTION	R/W	0	1	1		F52	0
	00039	(LR) ACCEL LOCKED ROTOR DETECTION	R/W	0	1	1		F52	0
	00040	(3F) THIRD FAILURE DETECTION	R/W	0	1	1		F52	0
	00041	ADDRESSES ARE RESERVED.							
	00042	UNDERCURRENT TYPE SETTING	R/W	0	1	1		F59	0
	00043	TRIP DELAY BECAUSE OF UC	R/W	5	600	1	s	F7	50
	00044	START UP DELAY AFTER UC	R/W	2	500	1	min	F7	5
	00045	ADDRESSES ARE RESERVED.							
	00046	(PF) UNDERCURRENT PF	R/W	3	9	1	PF/10	F7	5
	00047	(IN) UNDERCURRENT IN	R/W	30	90	1	%	F7	80
	00048	TRIP DELAY BECAUSE OF LR	R/W	20	120	1	s	F7	20
	00049	COMPENSATION BY TEMPERATURE	R/W	0	1	1		F7	0
	00050	(Ti) INITIAL TEMPERATURE SETTING	R/W	20	150	1	°C	F7	40
	00051	(Tm) MAXIMUM MOTOR TEMPERATURE	R/W	50	200	1	°C	F7	105
	00052	ADDRESSES ARE RESERVED.							
INPUT	00053	DIGITAL INPUT 1	R	0	1	1		F7	
	00054	DIGITAL INPUT 2	R	0	1	1		F7	
ACCUMULATOR	00055	TOTAL HRS	R	0	59999940	1	min	F8	
CLOCK	00057	MINUTE	R/W	0	59	1	min	F7	
	00058	HOUR	R/W	0	23	1	Hour	F7	
	00059	DAY WEEK	R	1	7	1		F41	
	00060	DAY	R/W	1	31	1	Day	F7	
	00061	MONTH	R/W	1	12	1	Month	F7	
	00062	YEAR	R/W	0	45	1	Year	F7	
ADJUSTMENTS	00063	START MODE	R/W	0	1	1		F19	0
MEASUREMENT	00064	TEMPERATURE INPUT	R	-20	200	1	°C	F9	
	00065	FREQUENCY	R	400	700	1	Hz/10	F7	
	00066	PERIOD	R	14280	25000	1	uS	F7	
	00067	THERMAL CAPACITY	R			1		F5	
ADJUSTMENTS	00069	CONTROL_ON_OFF	R/W	0	8	1		F10	
	00070	AUX RELAY MODE	R/W	0	2	1		F7	1
OUTPUT	00071	CONTROL RELAY	R	0	1	1		F7	
	00072	AUX RELAY	R/W	0	1	1		F7	
STATUS	00073	FAULT	R	0				F18	
	00074	(TC) START UP DELAY	R	0	30000	1	s	F7	
MEASUREMENT	00075	VL1L2	R	0		1	VAC	F7	
	00076	VL2L3	R	0		1	VAC	F7	
	00077	VL3L1	R	0		1	VAC	F7	
	00078	V AVERAGE	R	0		1	VAC	F7	
	00079	IA	R	0		1	AMP/10	F7	

	00079	IA	R	0		I	AMP/10	F7	
	00080	IB	R	0		I	AMP/10	F7	
	00081	IC	R	0		I	AMP/10	F7	
	00082	I AVERAGE	R	0		I	AMP/10	F7	
FAULT HISTORY	00083	TOTAL_NUMBER_OF_FAULTS	R/W	0	20	I		F7	0
	00084	LAST_FAILURE_POINTER	R	0	19	I		F7	
MEASUREMENT	00085	TEMPERATURE CAPACITY	R	0	65535	I	%	F7	
	00086	REAL POWER (kW)	R	0	9999	I		F45	
	00087	REACTIVE POWER (kVA),	R	0	9999	I		F45	
	00088	ENERGY CONSUMPTION (kWH)	R	0	99999999	I	10xW/H	F8	
	00090	(PF) POWER FACTOR	R	0	100	I		F7	
	00091	DYNAMIC THERMAL CLASS	R	6	20	I		F7	
TIMERS	00092	TOTAL NUMBER OF STARTS	R	0	65535	I		F7	I
	00093	CONTADOR_DE_AF	R	0	65535	I		F7	
RESTORE	00094	NUMBER OF STARTS MANUAL	R/W	0	I	I		F7	
SCHEDULE TIMER	00256-00375	EVENT 01/60 - 60/60	R/W	0				F11	
	00512-00531	HOLIDAY 01/20 - 01/20	R/W	0				F13	
FAULT HISTORY	00768-00867	FAULT 01/20- 10/20	R	0				F12	

12.1 MODBUS DATA FORMAT

CODE	TYPE	DESCRIPTION
F0	8 bits	PRODUCT ID
	12	ECA500-11
F1	8 bits	PRODUCT MODEL
	bits 2...0	VOLTAGE MODEL (1 to 4):
		0 = Reserved
		I = 120 - 120 V
		2 = 208 - 208/220 V
		3 = 380 - 380 V
		4 = 480 - 440/480 V
	bits 4...3	CURRENT MODEL (0 to 3):
		0 = 050 - 15 to 50 A
		I = 100 - 30 to 100 A
		2 = 180 - 55 to 180 A
		3 = 000 - CT External
	bits 6...5	LANGUAGE (0 to 3):
		I = SPANISH
		2 = ENGLISH
		3 = PORTUGUESE
	bit 7	0 = S - STANDARD - Product without SCHEDULE TIMER
		I = + - SCHEDULE TIMER - Product with SCHEDULE TIMER
F2	8 bits	SOFTWARE VERSION
	bits 4...0	Software Version - Minor Number(0 to 31)
	bits 7...5	Software Version - Major Number (0 to 7)
F3	16 bits	MODBUS_ADDRESS
	byte 0	Address (1 to 127)
	byte 1	null. not used
F4	16 bits	UNSIGNED INT - WRITE PROTECTION INDICATOR
	0x0000	Unprotected Adjustments
	0x0001	Protected Adjustments
F5	32 bits	Float 24bits
	0xNNNNNN00	Float 24 bits
F7	16 bits	Unsigned int
F8	32 bits	Unsigned Long
F9	16 bits	Signed int
F10	16 bits	ADJUSTMENT - CONTROL ON/OFF
	0	ON
	I	OFF - FAILURE MODE
	2	OFF - TRIP DELAY BECAUSE OF VOLTAGE FAILURES
	3	OFF - MODBUS
	4	OFF - MANUAL MODE
	5	OFF - 3RD FAILURE
	6	OFF - SCHEDULER TIMER (Only products with Schedule Timer)
	7	OFF - TRIP DELAY BECAUSE OF CURRENT FAILURES
	8	OFF - TRIP DELAY BECAUSE OF (UC)
F11	32 bits	EVENTS OF SCHEDULE TIMER

	bits 5. ..0	ON Hour — 0 to 23 - Hour to start the event
	bits 10... 6	ON Minute — 0 to 59 - Minute to start the event
	bits 16...11	OFF Hour — 0 to 23 - Hour to stop the event
	bits 21...17	OFF Minute — 0 to 59 - Minute to stop the event
	bits 23...22	null. not used
		Weekday
	bits 24	MONDAY
	bits 25	TUESDAY
	bits 26	WEDNESDAY
	bits 27	THURSDAY
	bits 28	FRIDAY
	bits 29	SATURDAY
	bits 30	SUNDAY
	bits 31	HOLIDAY
F12	80 bits	FAULT HISTORY
		Fault Type (0 to 13)
		0 = FS — Frequency Shift
		1 = PR — Phase Reversal
		2 = VSP - Voltage Single Phasing
		3 = VUB - Voltage Unbalance
		4 = UV — Undervotage
		5 = OV — Overvoltage
	byte 0	6 = RL — LR
		7 = PF — Power Factor
		8 = CUB - Current Unbalance
		9 = UC — Undercurrent
		10 = OL — Overload
		11 = CSP - Current Single Phase
		12 = SM — Start Motor
		13 = TEF — Total Energy Fault
	byte 2...1	VALUE - Fault Value Indication
	byte 3	PHASE - Phase involved in fault
	byte 4	DAY: 1 to 31
	byte 5	MONTH: 1 to 12
	byte 6	HOUR: 0 to 23
	byte 7	MINUTES: 0 to 59
	byte 9...8	Duration: 0 to 9999 min
F13	16 bits	HOLIDAY - Indicate how "Holiday" are stored
	byte 0	DAY
	byte 1	MONTH
F18	16 bits	FAULT REGISTER
	0	No Fail
	bit 0	Fail - FS - Frequency Shift
	bit 1	Fail - PR - Phase Reversal
	bit 2	Fail - VSP - Single Unbalance
	bit 3	Fail - VUB - Voltage Unbalance
	bit 4	Fail - UV - Undervoltage
	bit 5	Fail - OV - Overvoltage
	bit 6	Fail - RL - LR
	bit 7	Fail - PF - Power Factor
	bit 8	Fail - CUB - Current Unbalance

F18	16 bits	FAULT REGISTER
	bit 9	Fail - UC - Undercurrent
	bit 10	Fail - OL - Overload
	bit 11	Fail - CSP - Current Single Phase
F19	1 bits	START MODE
	0	MANUAL
	1	AUTO
F35	16bits	Unsigned int - UNDER VOLTAGE SETTING - UV
	Value	Factory Setting = 108V - Min = 95V - Max = 115V @ model = 120 - 120V
		Factory Setting = 187V - Min = 165V - Max = 225V @ model = 208 - 208/220V
		Factory Setting = 360V - Min = 320V - Max = 380V @ model = 380 - 380V
		Factory Setting = 432V - Min = 350V - Max = 460V @ model = 480 - 440/480V
F36	16bits	Unsigned int - OVER VOLTAGE SETTING - OV
	Value	Factory Setting = 132V - Min = 125V - Max = 145V @ model = 120 - 120V
		Factory Setting = 229V - Min = 215V - Max = 270V @ model = 208 - 208/220V
		Factory Setting = 440V - Min = 420V - Max = 480V @ model = 380 - 380V
		Factory Setting = 528V - Min = 460V - Max = 580V @ model = 480 - 440/480V
F39	16bits	Unsigned int - NOMINAL CURRENT SETTING
	Value	Factory Setting = 25A - Min = 15A - Max = 50A @ model = 50A
		Factory Setting = 45A - Min = 30A - Max = 100A @ model = 100A
		Factory Setting = 60A - Min = 55A - Max = 180A @ model = 180A
		Min = 100A - Max = 133A - CT = 400/5 @ model = CTs EXT
		Min = 125A - Max = 166A - CT = 500/5 @ model = CTs EXT
		Min = 150A - Max = 200A - CT = 600/5 @ model = CTs EXT
		Min = 187A - Max = 250A - CT = 750/5 @ model = CTs EXT
		Min = 200A - Max = 266A - CT = 800/5 @ model = CTs EXT (FACTORY SETTING)
		Min = 250A - Max = 333A - CT = 1000/5 @ model = CTs EXT
		Min = 300A - Max = 400A - CT = 1200/5 @ model = CTs EXT
		Min = 375A - Max = 500A - CT = 1500/5 @ model = CTs EXT
		Min = 500A - Max = 666A - CT = 2000/5 @ model = CTs EXT
F41	16 bits	DAY OF THE WEEK
	1	MONDAY
	2	TUESDAY
	3	WEDNESDAY
	4	THURSDAY
	5	FRIDAY
	6	SATURDAY
	7	SUNDAY
F42	1 bits	AC POWER FREQUENCY SETTING
	0	50Hz
	1	60Hz
F44	16 bits	CT SETTING - indicate the installed CT / 5
	0	400
	1	500
	2	600
	3	750
	4	800
	5	1000
	6	1200
	7	1500
	8	2000
F45	16 bits	Unsigned int - VALUE OF REAL POWER (kW) AND REACTIVE POWER (kVA)
	Value	Real Power W = Value * 10W @ model = 50A, 100A, 180A
		Real Power W = Value * 100W @ model = CTs EXT
		Reactive Power VA = Value * 10VA @ model = 50A,100A, 180A
		Reactive Power VA = Value * 100VA @ model = CTs EXT
F52	16 bits	Setting YES / NO
	0	NO
	1	YES
F59	16 bits	UNDERCURRENT TYPE SETTING
	0	%Inom
	1	(PF) Power Factor

■ ECA500-11 Technical Specifications

A) Power Supply Circuit

a.1	Rated Voltage, Ue	208/220/240	440/480	VAC
a.2	Voltage Operation Limits, Ue	145►312	264►672	VAC
a.3	Average Comsumption, In	38 mA		
a.4	Frequency Operation Limits, FN	42→70Hz		50/60 Hz
a.5	Rated Duty	Uninterrupted Duty		

B) Application Data, Environmental Conditions, Operation Limits and Installing

b.1	Designed according to European Standards	IEC61010-1, IEC60255-6 IEC60947-1	LVD & EMC
b.2	UL Listing	Aux. Device NKCR Certified for USA Aux. Device NKCR7 Certified for Canada	E527483
b.3	CE Marking	CE (pending), Low Voltage Devices	IEC60947-1
b.4	Ambient Air Temperature (Operation)	-5 °C to 55 °C (23 °F to 131 °F)	
b.5	Ambient Air Temperature (Storage)	-10 °C to + 70 °C (14 °F to 158 °F)	
b.6	Maximum Relative Humidity	85% R.H.	
b.7	Vibrations	Class 1, Amplitude <0.035mm or 1G 10Hz < f < 150Hz	IEC 60255-21-1
b.8	Shocks	Class 1, < 15G@16 ms	IEC 60255-21-2
b.9	Seismic	Class 1, Amplitude < 3.5mm or 1G 1Hz < f < 35Hz	IEC 60255-21-3
b.10	Degree of Protection	IP20, Protected against objects > 12.5mm, but no protection against water	IEC 60529
b.11	Pollution Degree	Degree 3	IEC 60255-5
b.12	Overvoltage Category	Category III, 4KV	IEC 60255-5
b.13	Rated Insulation Voltage	500V	UL-IEC 60255-5
b.14	Impulse Voltage Test	5 KV	IEC 60255-5
b.15	Impulse Dielectric Test	2 KV 50/60 Hz@1min	UL-508
b.16	Flammability Rating of Enclosure	V-0	UL-94
b.17	Enclosure Material	Polymers: PC, ABS, NYLON	
b.18	Mounting Position	Any Position	
b.19	Mounting Features	Symmetrical DIN Rail	IEC 715, DIN 43880
		Flat surface mounting, (2) #8 x 1/2" screws	NEMA Style
	Terminal Screw Type	Flat M2.5	
b.20	Tightening Screw Torque	<5.2 Kgf.cm (4.5 lbf.in)	
	Terminals Wiring	AWG 30-12, L=7-8mm (5/16)	
b.21	Detachable CT Box	Φ ≤ 18 mm maximum AWg 0	
b.22	Dimensions	175 x 90 x 78.0 (LxWxH)	mm
b.23	Dimensions Detachable CT Box	175 x 90 x 79.8 (LxWxH)	mm
b.24	Dimensions GIII +CT Box	175 x 90 x 157.8 (LxWxH)	mm
b.25	Weight	482g (1.604lb)	ECA500-11
		882 g (1.940lb)	Detachable CT box
		1364 g (3lb)	ECA500-11 + Detachable CT Box

C) Control Characteristics

c.1	Output Contact Rating	3 A@240 VAC, 1.5 A@480 VAC Pilot Duty	UL 508 Section 139.1
c.2	Electrical Life Expectancy	100.000 Operations	
c.3	Mechanical Life Expectancy	10.000.000 Operations	
c.4	Utilization Category	AC-15, Capacity for loads> 72 VA	IEC60947-5-1

D) Range Settings & Measurements

(According to Voltage Model)		208/220/240	440/480	VAC	
d.1	Voltage Measurement Range, Um	0 ►300	0 ►672	VAC ± 2% accuracy	
(According to Current Model)		15-50	30-100	55-180	EXT(CT/S)
d.2	Current Measurement Range, Im	1.5 ►350	3.0 ►700	5.5►1800	5%-333%CT	A, ± 2% accuracy

Other Measured parameters

d.3	Frequency Range	45.0 →70.0 Hz	1%
d.4	Instantaneous Power Factor	0.00 →1.00 Hz	8%
d.5	Instantaneous Power KW	0.0 →999.9 KVA	4%
d.6	Instantaneous Power KVA	0.0 →999.9 Hz	4%
d.7	Energy	0→ 999999 kWh	4%
d.8	Total Motor Running Time (hours)	0→ 999999 H	1%
d.9	Digital Input 1	0→1	R<1K→ON R>10K→OFF Dry Contact
d.10	Digital Input 2	0→1	R<10K→ON R>100K→OFF Dry Contact
d.11	Temperature Input	-20℃ →200℃	1%

E) Algorithms and Protection Functions

(According to Operation Voltage)		208/220/240	440/480	VAC
e.1	Undervoltage (UV)@Imotor= 0 or OL	165→225	350→460	Level settings
e.2	Overvoltage (OV) @ Imotor=0 or OL	215→270	460→580	Level settings
e.3	Voltage Hysteresis Threshold	6	12	VAC
e.4	Voltage Unbalance Detection (VUB)	2% →20%		Level settings
e.5	Single Phasing (VSP)	INV VUB > 33%, OUT VUB < 28%		
e.6	Nominal Frequency	50 or 60 Hz		Level settings
e.7	Tolerance for Frequency Shift (FS)	2% →10%		Level settings
e.8	Phase Reversal (PR)	Normal Sequence ABC, Reversal Sequence CBA		
e.9	Trip Delay because of Phase Reversal	< 1 sec.		
e.10	Trip Delay because of other Voltage Failures (TD)	1 →30 sec.		Level settings
e.11	Start Up Delay (TC)	0 →600 sec.		Level settings
e.12	Start Mode	Auto/Manual		User selection
e.13	Minimum Time Between Two Start Up	50 x Thermal Class		Sec.

(According to Operation Current)		15-50	30-100	55-180	EXT(CT/S)	
e.14	Nominal Current Setting	15 →50	30 →100	55 →180	25% → 33 CT	(A). Level settings
e.15	Overload Level Setting (OL)	5% →50%				(Inom). Level settings
e.16	Thermal Class Setting	Class 5 → Class 30				Level settings
e.17	Dynamic Setting of Motor Model (Cold Curve/Hot Curve)	Thermal class varies from 1→1/3 of adjusted class according to start up time and motor load level				IEC 60255-5
e.18	Maximum Time Between Cold/Hot Curve	2 Hours (from 1 to 1/3 or from 1/3 to 1)				IEC 60255-8-1990
e.19	Trip Delay because of Overload	According to Overload Level and Adjusted Class				IEEE Std. C37.112-1996
e.20	Heat Threshold because of Overload Failure	100%				
e.21	Current Unbalance (CUB)	CUB >48%				Heat adjust to 100%
e.22	Current Single Phase (CSP)	CUB>60%				Heat adjust to 100%
e.23	Accelerated Locked Rotor Detection (LR)	YES/NO				User selection Heat setting to 100%
e.24	Trip Delay because of CUB	3				Sec.
e.25	Trip Delay because of CSP	4				Sec.
e.26	High-Inertia Load Option	YES/NO				User selection.
e.27	High-Inertia Load Heat Threshold	400%				
e.28	High-Inertia Load Start up Delay	20 →120				Sec. Level settings
e.29	Thermal Machine Cooling Time	50 x Thermal Class				Sec.
e.30	Undercurrent Disconnection Type (UC)	% Inom / Power Factor (PF)				Level settings
e.31	Undercurrent Adjusting (by Inom)	40% → 80%				Inom. Level settings
e.32	Undercurrent Adjusting (by PF)	0.3 → 0.9				Level settings
e.33	Trip Delay because of UC	5 →600				Sec. Level settings
e.34	Start Up Delay because of UC	5 →500				Min. Level settings
e.35	Third Failure Detection	YES/NO				Level settings
e.36	Permanent disconnection because of Third Failure	3 Current failures in less than 30 minutes				User selection

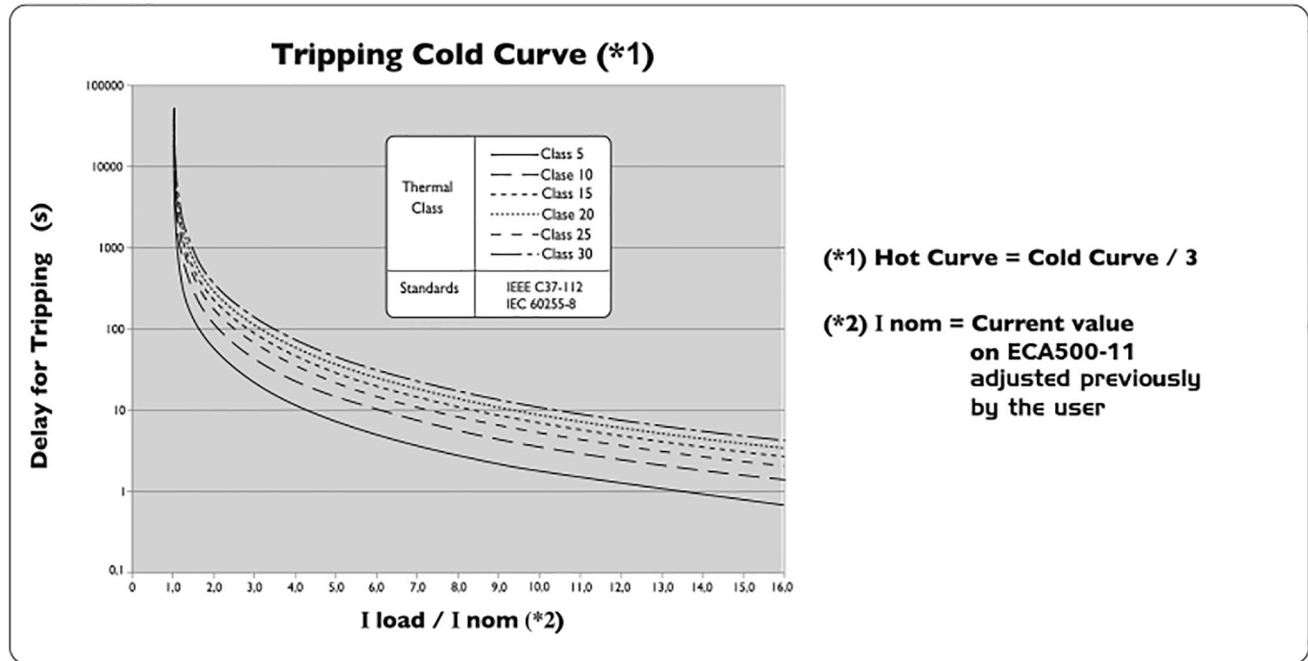| e.39	Trip Delay because of Accelerated Locked Rotor	3	Sec.
Temperature sensor characteristics			
e.40	Compensation by Temperature (**Bias**)	YES/NO	User selection
e.41	Initial Temperature Setting (T_i)	20 → 150	IC Degrees
e.42	Maximum Motor Temperature (T_m)	50 → 200	IC Degrees
e.43	Sensor Type	Platinum 100 Ohm, 3 Wires (PTC 100) compatible with 2 and 4 wires	—
Events control characteristics			
e.44	Real Time Clock	hh:mm mm/dd/yy	UMT
e.45	Load Control by Events (schedule)	YES/NO	User selection
e.46	Schedule Timer (events)	60	User selection
e.47	Schedule Timer (holidays)	20	User selection

F) Communications and Other Special Functions

f.1	Communication Protocol	MODBUS RTU @ 9600 8N1	See User Manual
f.2	Communication Ports	Port IO PORT (*)	See User Manual
		Port RS-485	
f.3	Address Range	1 → 127	—
f.4	History Buffer Memory	20 last faults report (failure type, value, date, hour and time elapsed)	See User Manual
f.5	Parameters Block	0000 Free, 0001 → 9999 Blocked	User selection

(*) IO-Link-RS485K Plug is required for IO Port communication and is available separately.
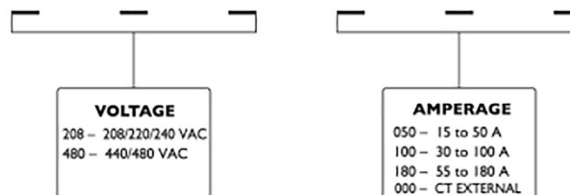
G) Immunity and Emissions, Electromagnetic Interference (EMC) for Heavy Industrial Environment

g.1	Electrostatic Discharge	IEC 61000-4-2
g.2	Radiated Immunity	IEC 61000-4-3
g.3	Electrical Fast Transients	IEC 61000-4-4
g.4	Surge Immunity Test	IEC 61000-4-5
g.5	Conducted Immunity Induced by RF	IEC 61000-4-6
g.6	Power Frequency Magnetic Field	IEC 61000-4-8
g.7	Voltage Dips, Short Interruptions and Voltage Variations	IEC 61000-4-11
g.8	Harmonics and Interharmonics Immunity Tests	IEC 61000-4-13
g.9	Voltage Fluctuation Immunity	IEC 61000-4-14
g.10	Unbalance Immunity Test	IEC 61000-4-27
g.11	Variation of Power Frequency	IEC 61000-4-28

Tripping Cold Curve (*1)

Thermal Class: Class 5, Clase 10, Class 15, Clase 20, Class 25, Class 30

Standards: IEEE C37-112, IEC 60255-8

Delay for Tripping (s) vs I load / I nom (*2)

(*1) **Hot Curve = Cold Curve / 3**

(*2) **I nom = Current value on ECA500-11 adjusted previously by the user**

■ HOW TO ORDER ECA500-11

ECA500-11

VOLTAGE
208 – 208/220/240 VAC
480 – 440/480 VAC

AMPERAGE
050 – 15 to 50 A
100 – 30 to 100 A
180 – 55 to 180 A
000 – CT EXTERNAL

Note: Technical data is valid at the time of printing. We reserve the right to subsequent alterations

ECA PRODUCTS

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