



Installation, Maintenance & Troubleshooting Guide For RAJA⁺ Agriculture Starters & Controllers



SIEMENS



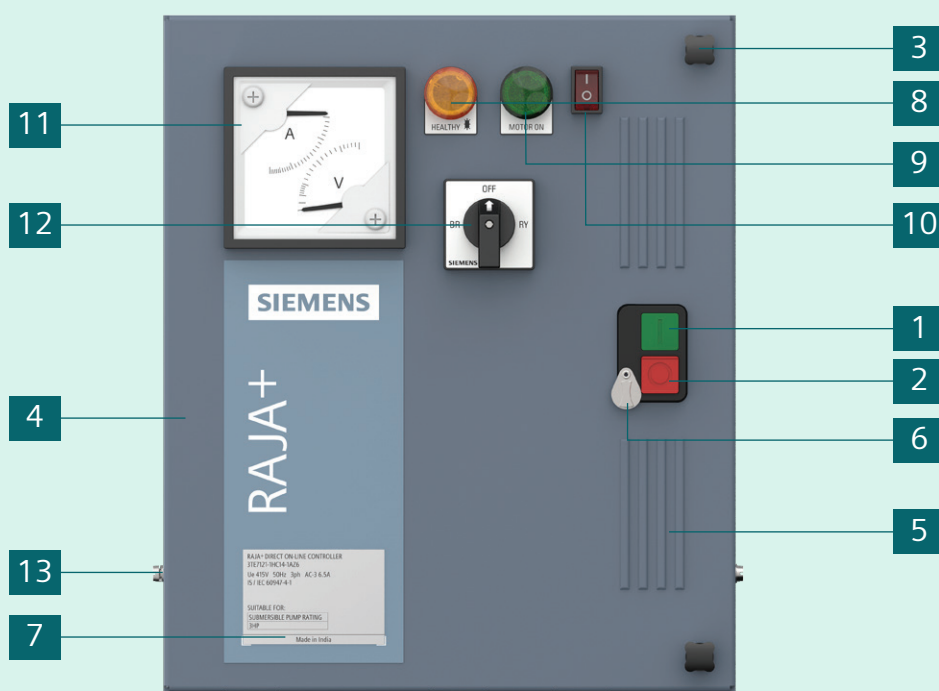
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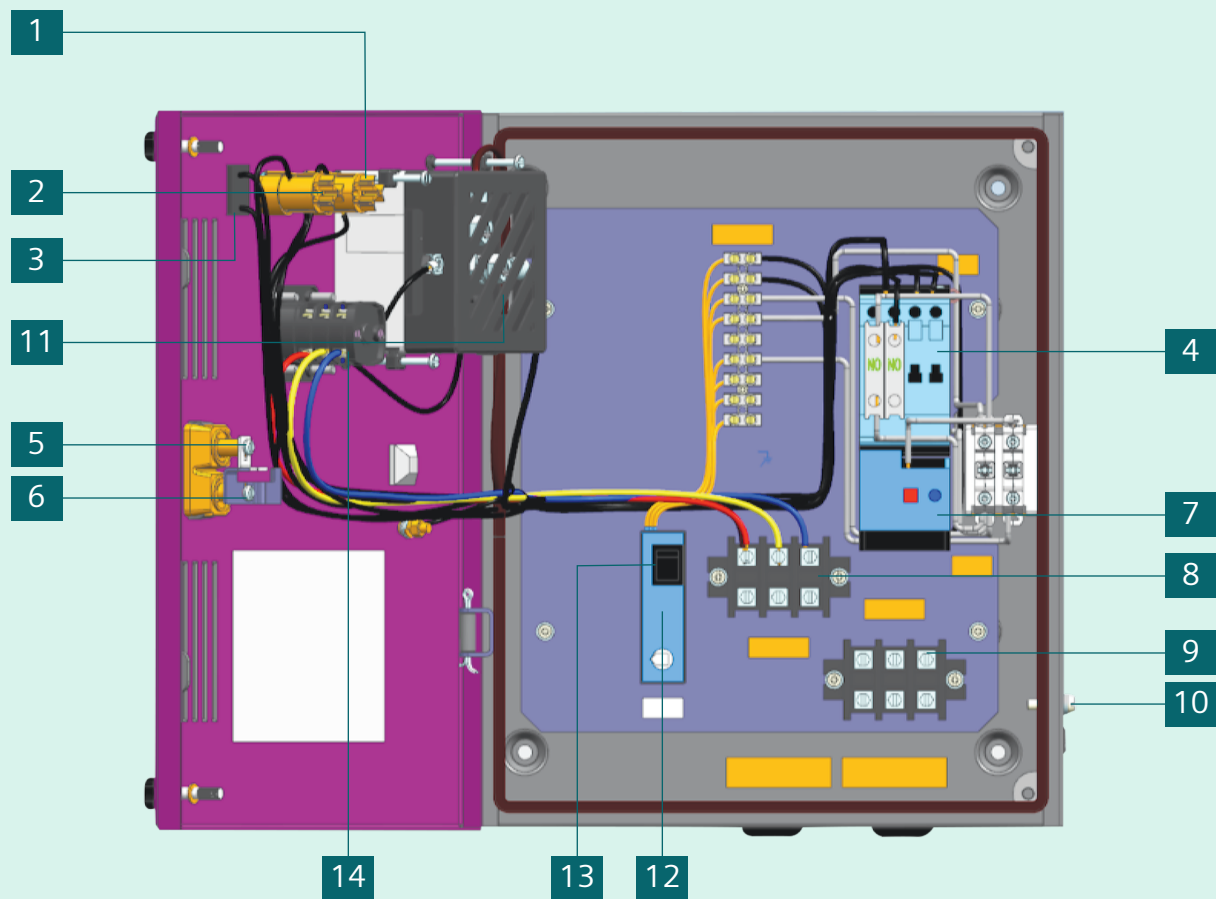
Product: Direct On Line Controller

3.1: Product description



1. 'ON' push button (green)
2. 'OFF/RESET' push button (red)
3. Door knob
4. Metal Enclosure
5. Door
6. Mechanical Latch (OFF push button) to be used for preventing undesired ON operation of Starter
7. Name plate
8. LED (amber) to indicate availability and healthiness of incoming power supply
9. Green LED to indicate Motor ON status
10. Rocker switch (Control ON/OFF)
11. Dual VA meter (For indication)
12. Phase Selector switch
13. Earthing screw

Inside view of Direct On Line Controller



1: Amber LED

2: Green LED

3: Rocker Switch

4: Contactor

5: ON push button

6: OFF push button

7: Thermal Overload Relay

8: Terminal Block TB1

9: Terminal Block TB2

10: Earthing Screw

11: AV meter

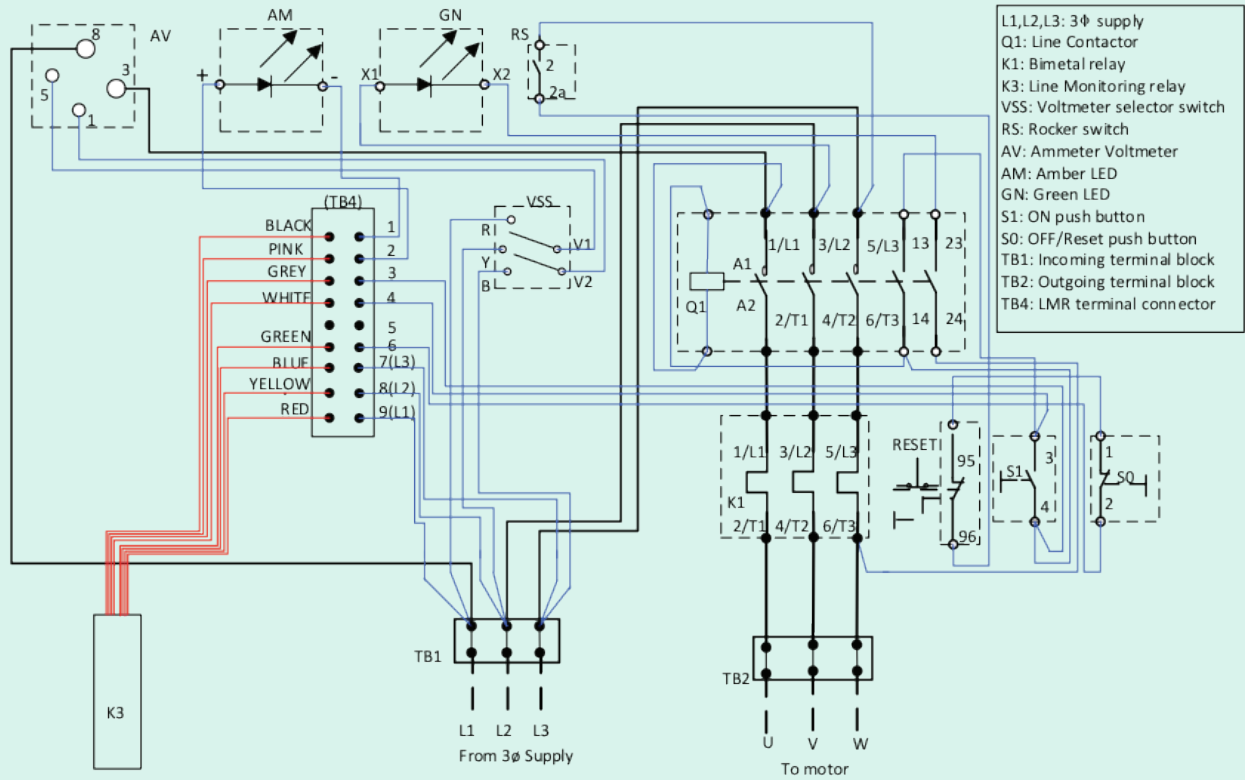
12: Line monitoring relay

13: Starter Operating Modes

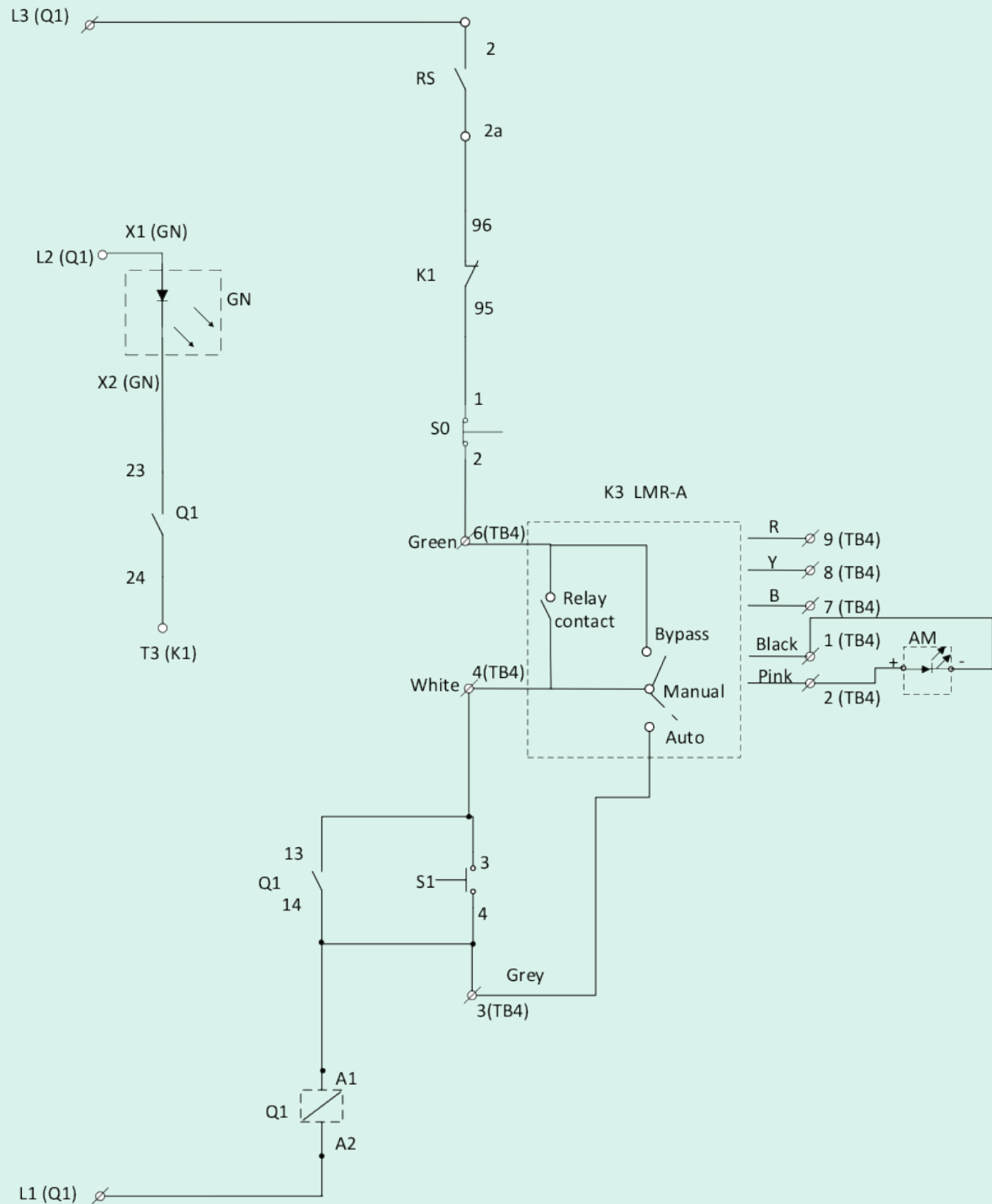
14: Phase selector switch

Fig.8

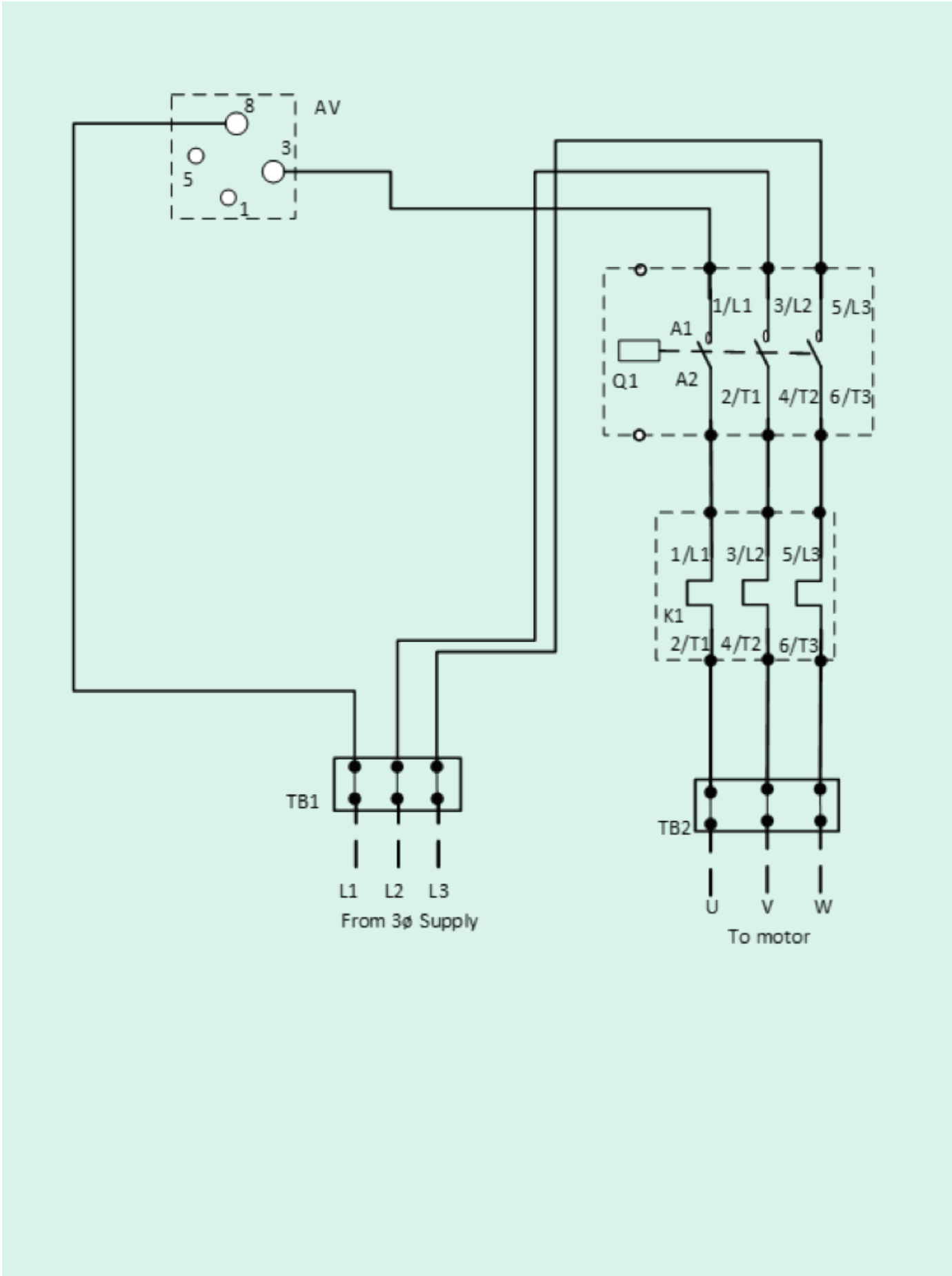
3.2: Wiring Diagram: DOL Controller



3.21 Control logic diagram



3.22 Power circuit diagram



3.3: Technical details

Table: 15 Technical details of DOL Controller

Type	(HP / kW)	I _e (A)	Contactor	Relay	Range (A)	Line Monitoring Relay	Recommended Max. Back-up HRC Fuse rating, SIEMENS Make type 3NA7 – 500V*	Max. Recommended Cu cable size (sq:mm)
3TE7121-1HC14-1Axx	3 / 2.2	6.5	3TS3010-0Axx-08K	3US5000-1H8K	5-8	7UG0613-0yy20	20A/500V	1.5
3TE7121-1KC16-1Axx	5 / 3.7	10	3TS3110-0Axx-08K	3UW5102-1K	8-12.5	7UG0613-0yy20	25A/500V	1.5
3TE7121-2AC17-1Axx	6 / 4.5	12	3TS3210-0Axx-08K	3UW5102-2A	10-16	7UG0613-0yy20	25A/500V	1.5
3TE7121-2BC18-1Axx	7.5 / 5.5	14.5	3TS3210-0Axx-08K	3UW5102-2B	12.5-20	7UG0613-0yy20	25A/500V	2.5
3TE7121-2CC21-1Axx	10 / 7.5	19.5	3TS3311-0Axx-08K	3UW5202-2C	16-25	7UG0613-0yy20	32A/500V	2.5

Note: xx: Coil voltage; Z6:200-400V AC; Z8: 260-460V AC
 yy: Coil voltage; FE:200-400V AC; FF: 260-460V AC

*Type 1 coordination as per IS/IEC 60947-4-1 Standard.



3.4: Installation

- Open the door by rotating the door lock anticlockwise.
- Mount the starter on a vertical wall/ plate free from vibrations with proper nuts and bolts. Refer operating instruction for mounting dimensions.
- Remove the rubber grommets for the incoming and outgoing cable connections. (Refer Fig. 8)
- Connect incoming and outgoing cables as follows (Refer Fig. 8):
 - Use proper cable glands to ensure dust proofing. For conduit entry use packed washers.
 - Select correct size of cables from Table 15
 - Connect line and motor leads exactly as per wiring diagram pasted inside the cover of the starter.
 - Terminate the incoming supply cables on terminal block TB1 & outgoing cables to motor on terminal block TB2, (Tightening torque -Refer table 15B)
NOTE: LMRA is set in Manual mode (Factory setting)
 - Connect the earthing conductor to terminals marked (earth) on the starter body with torque 1.2 to 1.6Nm.

The Starter is now ready for commissioning.

Commissioning :

For exact setting of overload relay, follow the instruction given below:

Before switching ON recheck all external connections.

- **Overload relay setting:**
 - For closer protection set the overload relay to actual phase current as measured by an ammeter. In the absence of an ammeter, use the procedure given below:
 - Start the motor and let it run for 30 mins. Then gradually reduce the relay settings till it trips. Set the relay at a slightly higher value than this setting. Overload relay characteristics shown in Fig. 6 can be used to estimate the average tripping time at different multiples of set current.
 - Allow a reset time of approx. 4 min. before pressing the blue knob on the relay to reset it.
 - Restart the motor after some time. If the relay does not trip then consider it to be properly set. If the relay trips, set at a little higher value than before and recheck.
- **Close the front door.**

Caution

- During commissioning or maintenance always ensure that the main supply is disconnected by switching off the main switch & Rocker switch.
- If the relay trips even when set at rated motor current the suitability of the starter/relay for the particular application should be checked with the nearest Siemens office.

Operating Characteristics:

The given characteristics (Fig. 6) are average values of all ranges and sizes of bimetal relays and are mainly intended to indicate the inverse time current characteristics & tripping times of the same. The tripping times shown are for relays starting from the cold state. At operating temperatures (heated at rated current) these are reduced to about 25% of the value obtained from the characteristics.

Operation:

- Ensure the door is closed.
- Rotate the Latch away from OFF push button
- Switch On the rocker switch.
- Check the status of amber LED. Wait till amber LED is continuously ON then only proceed.
- Depending upon Selector switch knob position for phase selection, Indication of incoming power supply voltage can be seen on Dual VA meter.
- For starting the motor, press Green push button marked 'I' (Fig. 7)
- Line current of R phase is indicated by Dual VA meter.
- Indication of Motor ON can be seen on starter door through green LED.
- For stopping the motor press Red push button marked 'O' (Fig. 7)

Reset Operation

- If the overload relay trips, Reset manually.
(Allow a reset time of approx. 4 min.)

Table: 15A Mounting torque values

Sr. No	Location	Size	Torque
1	Earthing screw (cover to body)	M5	2.5-3.0Nm
2	Contactors 3TS30..33	M4	0.8-1.4Nm
3	LMR-A	M4	0.8-1.4Nm
4	Terminal block 30A	M4	0.8-1.4Nm
5	ON& OFF /Rest link	ST4.2x9.5	0.8-1.2Nm
6	Dual VA Meter	M4	0.2-0.3Nm
7	Selector Switch 3LD4	M4	0.8-1.1Nm

Table: 15B Terminal torque values

Sr. No	Type	Size	Torque
1	3TS30..32	M4	0.8-1.4Nm
2	3TS33	M4	1.0-1.5Nm
3	Terminal block 30A	M4	0.8-1.4Nm
4	Contact block 3SB5	M3.5	0.8-1.2Nm
5	Coil Terminals A1/A2	M3.5	0.8-1.2Nm
6	Aux. terminals of all Relays	M3.5	0.8-1.2Nm
7	3UW51/52, 3US50	M4	1.0-1.5Nm
8	3TX4010-2A	M4	0.8-1.1Nm
9	Indicating light – Amber/Green	M3	0.8Nm
10	Dual VA Meter – Current terminals	M4	1.2Nm
11	Dual VA Meter – Voltage terminals	M4	1.2Nm
12	3TS30..32	M4	0.8-1.4Nm

3.5: Operating procedure in normal condition

Table: 11 FASD starter operating sequence in normal condition

7A	7B	7C	7D	7E	7F	7G	7H	7I
LMR-A Mode	3 ϕ main supply	Rocker switch	Amber LED	LMR-A On-Delay	Amber LED	'ON' Push button	Starter Operation	Starter Operation
Manual	ON	ON	Blink (On-delay duration)	0.5-5min	ON	ON	ON	ON
Auto	ON	ON	Blink (On-delay duration)	0.5-5min	ON	NA	ON	ON
Bypass	ON	ON	Blink (On-delay duration)	0.5-5min	ON	ON	ON	ON
ON operation								

7J	7K	7L	7M	7N
Starter Operation	Green LED	Amber LED	3 ϕ main supply	Amber LED indication
OFF	OFF	ON	OFF	OFF
OFF	OFF	ON	OFF	OFF
OFF	OFF	ON	OFF	OFF
OFF operation				

Starter operation:

LMR-A: Manual mode

7A : Keep the LMR-A in Manual mode.

7B : Switch ON 3-Phase incoming main supply.

7C : Turn ON the rocker switch

7D : Amber LED will start blinking for a period of min 0.5 min.

7E : 0.5 min is the default setting which can vary from min 0.5 min to max.5min.

7F : After the ON-delay duration, amber LED will ON continuously indicating that the incoming supply is Healthy (Assuming incoming supply is healthy).

7G : Press the green push button for switching ON the starter.

7H : Starter gets switched ON

7I : Green LED turns ON indicating that the starter is ON.

7J : Starter switches OFF automatically after water tank level reach P3 sensor level.

7K : Green LED turns OFF indicating that the starter is OFF.

7L : Amber LED indication remains continuous ON.

7M : Switch OFF the 3-phase incoming main supply.

7N : Amber LED indication gets turned OFF indicating that there is no incoming main supply.

LMR-A: Auto mode

- 7A : Keep the LMR-A in Auto mode.
- 7B : Switch ON the 3-Phase incoming main supply.
- 7C : Turn ON the rocker switch.
- 7D : Amber LED will start blinking for a period of min 0.5 min.
- 7E : 0.5 min is the default setting which can vary from min 0.5 min to max.5min.
- 7F : After the ON-delay duration, amber LED will ON continuously indicating that the incoming supply is healthy(Assuming incoming supply is healthy).
- 7G : Not applicable (No need to press ON push button)
- 7H : Starter gets switched ON automatically.
- 7I : Green LED turns ON indicating that the starter is ON.
- 7J : Starter switches OFF automatically after the above step '1K'
- 7K : Green LED turns OFF indicating that the starter is OFF.
- 7L : Amber LED indication remains continuous ON.
- 7M : Switch OFF the 3-phase incoming main supply.
- 7N : Amber LED indication gets turned OFF indicating that there is no incoming main supply.

LMR-A: Bypass mode

- 7A : Keep the LMR-A in Bypass mode.
- 7B : Switch ON the 3-Phase incoming main supply.
*(*Customer may switch ON the starter directly after switching ON the 3 phase incoming supply irrespective of Blinking status as there is only indication for incoming supply faults and no Protection in Bypass mode).*
- 7C : Turn ON the rocker switch.
- 7D : Amber LED will start blinking for a period of min 0.5 min.
- 7E : 0.5 min is the default setting which can vary from min 0.5 min to max.5min.
- 7F : After the ON-delay duration, amber LED will ON continuously indicating that the incoming supply is healthy (Assuming incoming supply is healthy).
- 7G : Press the green push button for switching ON the starter.
- 7H : Starter gets switched ON.
- 7I : Green LED turns ON indicating that the starter is ON.
- 7J : Starter switches OFF automatically after delivery tank water level reach P3 sensor level.
- 7K : Green LED turns OFF indicating that the starter is OFF.
- 7L : Amber LED indication remains continuous ON.
- 7M : Switch OFF the 3-phase incoming main supply.
- 7N : Amber LED indication gets turned OFF indicating that there is no incoming main supply.

3.6: Troubleshooting Guidelines in case any incoming supply fault is present before switching ON the Starter

Table: 17 DOL Controller operating sequence in fault condition

8A	8B	8C	8D	8E	8F	8G	8H	8I	8J	8K	8L
LMR-A Mode	3 ϕ main supply	Rocker switch	Amber LED	LMR-A On-Delay	Amber LED	Possible causes of fault	Corrective action	Amber LED	'ON' Push button	Starter Operation	Green LED
Manual	ON	ON	Blink (On-delay duration)	0.5-5min	Blink	#	1)	ON	ON	ON	ON
Auto	ON	ON	Blink (On-delay duration)	0.5-5min	Blink	#	2)	ON	NA	ON	ON
Bypass	ON	ON*	Blink (On-delay duration)	0.5-5min	Blink	NA	NA	ON	ON	ON	ON
ON operation											

#: Phase loss¹, Phase reversal², Under voltage³, Over voltage⁴, Phase unbalance⁵

NA – Starter is unprotected from incoming power supply faults, only protection from load side faults. In this mode, amber LED will continuously ON if incoming power supply is healthy and will blink if the incoming power supply is unhealthy – Refer 3.8

Starter Fault condition:

1) LMR-A: Manual mode

8A : Check the mode of LMR-A, if it is manual mode.

8B : Switches ON the 3-Phase incoming main supply.

8C : Switch ON the rocker switch

8D : Amber LED will start blinking

8E : Amber LED will blink for a duration of min.30sec.

8F : After the ON delay duration, amber LED remains blinking indicating that the 3phase incoming supply is unhealthy.

¹8G : - Check the rated operational voltage of the starter in incoming terminal block (TB1) between L1- L2 , L2-L3, L1-L3 with suitable equipment e.g. multimeter.

- Check for the phase loss in any phase (L1,L2,L3) with suitable equipment e.g. multimeter.

¹8H : - After resuming incoming main supply to normal condition,

- Repeat the steps from 8A to 8F and then go to step no.8I

If fault still exists, then

²8G : - Check the phase sequence of all the phases of incoming main supply.

- Identify the wrong sequence of phase connected in any of the incoming terminal.

²8H : - Connect the phase sequence of all the phases correctly (R phase to L1 , Y phase to L2, B phase to L3) to the incoming main supply terminals of Terminal block TB1.

- Repeat the steps from 8A to 8F and then go to step no.8I

If fault still exists, then

- ³8G :- Check the rated operational voltage of the starter in incoming terminal block (TB1) between L1-L2, L2-L3, L1-L3 with suitable equipment e.g. multimeter.
- Check whether the 3-phase voltage in the incoming terminals of terminal block TB1 is <minimum required voltage (Refer table no.18).
- ³8H :- Keep the 3-phase voltage to the incoming terminals of terminal block TB1 to a voltage between min.required voltage & Max.voltage allowed (Refer table no.18).
- Repeat the steps from 8A to 8F and then go to step no.8I

If fault still exists, then

- ⁴8G :- Check the rated operational voltage of the starter in incoming terminal block (TB1) between L1-L2, L2-L3, L1-L3 with suitable equipment e.g. multimeter.
- Check whether the 3-phase voltage in the incoming terminals of terminal block TB1 is >Maximum voltage allowed. (Refer table no.18).
- ⁴8H :- Keep the 3-phase voltage to the incoming terminals of terminal block TB1 to a voltage between min.required voltage & Max.voltage allowed (Refer table no.18).
- Repeat the steps from 8A to 8F and then go to step no.8I

If fault still exists, then

- ⁵8G :- Check the rated operational voltage of the starter in incoming terminal block (TB1) between L1-L2, L2-L3, L1-L3.
- Check whether the operational line voltage difference between any 2 phase in the incoming. terminals of terminal block TB1 is >50V.
- ⁵8H :- Starter will be operational only if the incoming supply voltage difference between any 2 phase in the incoming terminal block TB1 of the starter is <=50V.
- Repeat the steps from 8A to 8F and then go to step no.8I
- 8I : Amber LED will remain ON continuously indicating that the fault is cleared
- 8J : Press the Green ON push button to switch ON the starter.
- 8K : Starter gets switched ON.
- 8L : Green LED turns ON indicating that the starter is ON.

Table: 18 Range of Under voltage & Over voltage

Starter Voltage Range (V)	Undervoltage fault		Overvoltage fault	
	Trip voltage for undervoltage fault (V)	Healthy voltage (V)	Trip voltage for Overvoltage fault (V)	Healthy voltage (V)
(Z6) 200-400	195	205	400	390
(Z8) 260-460	250	260	455	445

2) LMR-A: Auto mode

- 8A : Check the mode of LMR-A, if it is Auto mode.
- 8B to 8I : Follow steps from 8B to 8I of LMR-A Manual mode.(Corrective action 1)
- 8J : No need to press ON push button.
- 8K : Starter switches ON automatically.
- 8L : Green LED turns ON indicating that the starter is ON.

*** LMR-A: Bypass mode**

As in Bypass mode there is no protection from the incoming supply faults, however there may be some conditions, example mentioned below where Starter may not ON –

1. Phase loss
2. Incoming supply voltage less than the minimum required operational voltage of the Starter.
3. Incoming supply voltage is very high etc.....

In the above conditions check the Starters as explained in Auto & Manual Mode.

3.7: Troubleshooting Guidelines in fault condition when motor stops while it is in running condition

Table: 19 DOL Controller operating sequence in fault condition

9A	9B	9C	9D	9E	9F	9G	9H	9I	9J
Motor condition	LMR-A Mode	Amber LED	Possible causes of fault	Corrective action	Amber LED	'ON' Push button	Starter operation	Green LED	Motor condition
Not Running	Manual	Blink	#	1)	ON	ON	ON	ON	Running
Not Running	Auto	Blink	#	2)	ON	NA	ON	ON	Running
Not Running	Bypass	Blink	NA	NA	ON	ON	ON	ON	Running
ON operation									

#: Phase loss¹, Phase reversal², Under voltage³, Over voltage⁴, Phase unbalance⁵

NA – Starter is unprotected from incoming power supply faults, only protection from load side faults. In this mode, amber LED will continuously ON if incoming power supply is healthy and will blink if the incoming power supply is unhealthy– Refer 3.8

Starter Fault condition:

1) LMR-A: Manual mode

9A : Motor suddenly stops after running for some time.

9B : Check the mode of LMR-A, if it is Manual mode.

9C : Amber LED will start blinking

9D to 9I : Follow steps from 8G to 8L of Table 17 LMR-A manual mode (Corrective action 1)

9J : Motor starts running again.

2) LMR-A: Auto mode

9A : Motor suddenly stops after running for some time.

9B : Check the mode of LMR-A, if it is Auto mode.

9C : Amber LED will start blinking

9D to 9I : Follow steps from 8G to 8L of Table 17 LMR-A Auto mode (Corrective action 2)

9J : Motor starts running again.

3) LMR-A: Bypass mode

As in Bypass mode there is no protection from the incoming supply faults, however there may be some conditions, example mentioned below where Starter may not ON –

1. Phase loss

2. Incoming supply voltage less than the minimum required operational voltage of the Starter.

3. Incoming supply voltage is very high

etc.....

In the above conditions check the Starters as explained in Auto & Manual Mode.

3.8: Troubleshooting Guidelines in case any fault is at load side

Steps to be followed

Thermal overload relay provide protection from:

- a) overload condition at Motor
- b) single phasing at load side
 - a) overload condition at Motor: check the suitable Motor current rating and adjust the overload relay setting dial as per the requirement.
 - b) Single phasing at load side – Overload relay tripped as inbuilt feature to protect from single phase faults. Check the single phasing condition at Motor side terminal TB2,TB3 to Motor.

For both conditions restart the Starter after proper reset time of approx. 4 min.



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