



MOTOR DRIVE UNIT TYPE CMA9

Operating Instruction

Thank you for choosing our motor drive unit !

Prior to operating the motor drive unit you purchased, please make sure to read carefully this operating instructions.

Thanks!

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1.General

The motor drive CMA9 (fig.1,2) serves for driving tap changer type CV to selected operating position. It also can be used for some off-load tap changers.

The motor drive housing contains all mechanical and electrical parts necessary for operating the tap changer from one operating position to an adjacent one, the motor drive action is initiated by a single control signal and completed without any possible interruption.

Overrunning the end positions is prevented by double limits devices. Safety and monitoring devices are available with easy operation.

Auxiliary devices can be provided for various application requirement and retrofit project.

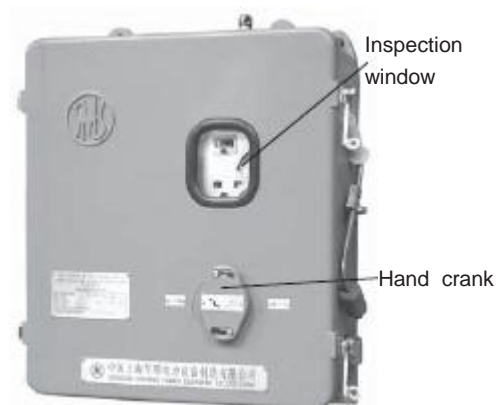


Fig. 1

Note: The installation of motor drive, electrical connection and operation must be carried out by the trained personnel according to the operating instructions. To replace or change the motor drive without permission of our company is not recommended. Failing to do so may cause severe

damage to tap changer and transformer.

During the period of installation of motor drive, electrical connection and operation, improper operation may have influence on the operation of motor drive, on-load tap changer and transformer.

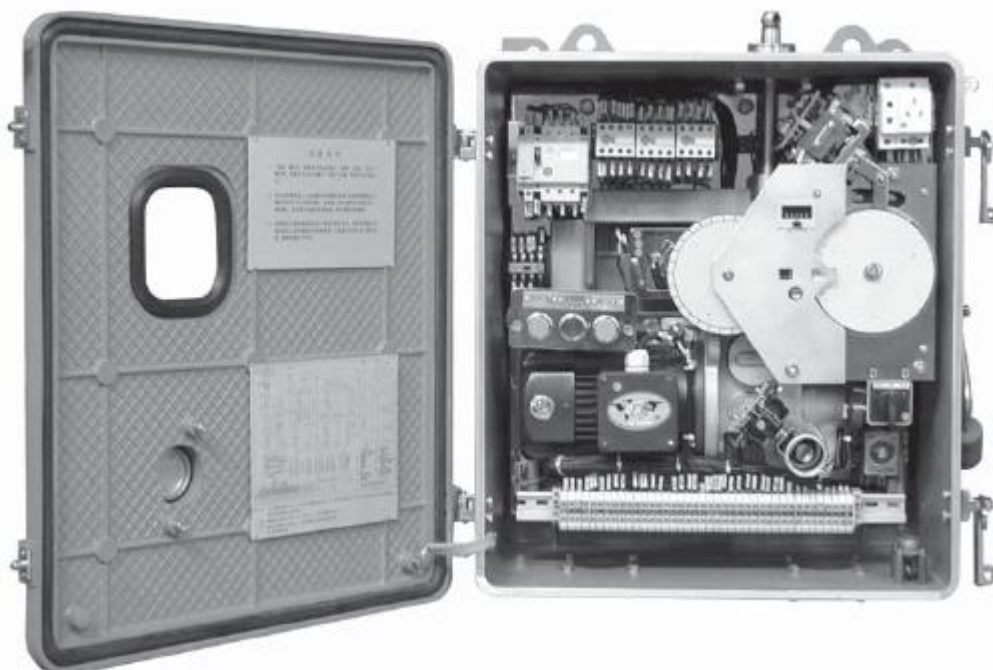


Fig. 2

2. TECHNICAL DATA

Note: The listed technical data only applies to standard design, there might be some differences with actual device, we reserve the right to make modification.

Item		Data
Motor	Rated power (W)	370
	Rated voltage (V)	AC 3 phase 380V
	Rated current (A)	1.1
	Frequency (Hz)	50
	Rotary speed (r/min)	1400
Output torque on drive shaft (Nm)		40
Revolution of drive shaft per tap change		2
Revolution of hand crank per tap change		30
Running time per tap change (S)		About 4
Max. number of operating positions		27
Voltage of control circuit and heater (V)		Single phase AC 220V
Energized power of control circuit (VA)		52
Power consumption of heater (W)		30
Insulation level to ground (50Hz, 1 min.)		2kV
Weight (kg)		70
Level of protection		IP56
Mechanical life of motor drive unit (operations)		800,000

2.1 Working condition of motor drive unit:

- 1) Applied altitude shall not exceed 2000 meters.
- 2) The ambient temperature shall be $-25 \sim +40^{\circ}\text{C}$
- 3) Vertical inclination of installation shall not exceed 2%.
- 4) Operation site should be free of dust, explosive or corrosive gases.

3. DESIGN

3.1 Mechanical structure

Note: The structure and device described in this section only applies to standard design, we reserve the right to make modification.

3.1.1 Housing (See figure 1)

The housing consists of two parts, the tank and the cover, both manufactured from corrosion-proof light-metal casting. The cover can easily be swung open. The swing-open direction is to the left side.

The joint between cover and cubicle are protected by a groove and sealed by rubber.

The apertures for drive shaft, inspection window and hand crank are sealed in a way that the housing is well-protected against jets of water.

For ventilating the housing, there are two labyrinth apertures in both sides of the tank.

The bottom of the tank consists apertures of cable entries,

which is temperately sealed by rubber when delivered.

3.1.2 Gearing (see fig.3)

The gearing consists of the transmission gear and the control gear. The transmission gear is provided with a box. The control gear is fixed to one side of the transmission gear. It comprises a cam wheel for mechanically operating the cam switches, the tap change indication wheel and the mechanical position indicator.

The tap change indication wheel as well as the cam wheel turn one rotation per switching operation. The green zone indicates the rest position of the cam switches. The initial position for a tap change operation is indicated by the red center mark in the green field.

3.1.3 Hand crank

The hand crank provided with a plastic handle is attached outside the housing by a wing nut clamp.

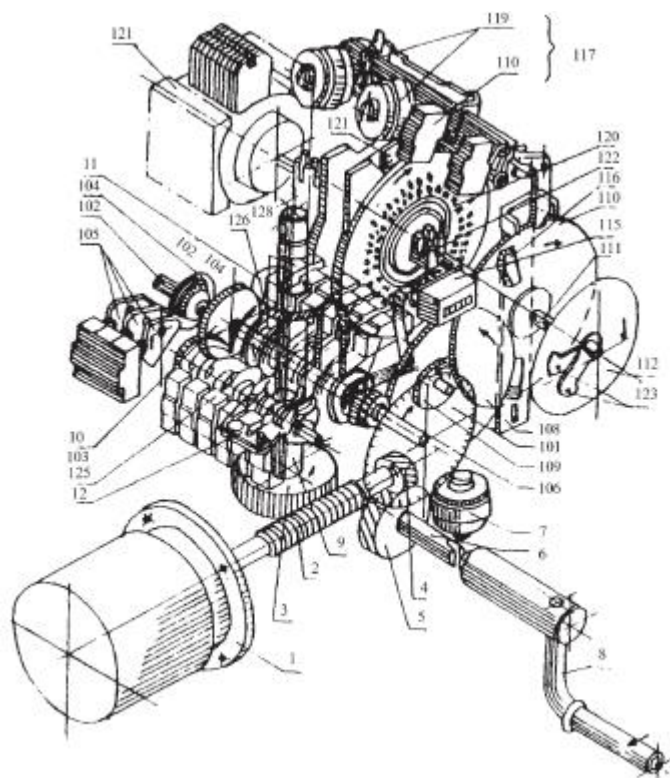


Fig. 3 Motor unit

Drive gear:

- 1 Driving motor
- 2 Driving worm $z=1, m=1.5$
- 3 Worm wheel $z=56, m=1.5$
- 4 Spiral gear $z=15, m=1$
- 5 Spiral gear $z=56, m=1$
- 6 Latch shaft
- 7 Safety switch for manual operation
- 8 Hand crank
- 9 Drive shaft
- 10 Spiral gear $z=52, m=1$
- 11 Spiral gear $z=26, m=1$

Control gear:

- 102 Control shaft
- 103 Coupling
- 104 Cam control
- 105 Step-by-step control switch
- 106 Gear $z=25, m=1$
- 107 Step progress position indication wheel
- 108 Cog wheel $z=132, m=1$
- 109 Intermediate gear $z=22, m=1$
- 110 Limit protection gear wheel
- 111 Limit position wheel
- 112 Position indication wheel
- 115 Operation counter
- 116 Limit stop block
- 117 Electrical limit switch
- 118 Control circuit limit switch
- 119 Main circuit limit switch
- 120 Position indication wheel (static contact lever)
- 121 Position indication wheel (action contact lever)
- 122 Coupling
- 123 Follower block
- 126 Gear $z=56, m=1$

3.1.4 Counter

The electrical counter records the switching operations performed. For reading the counter it is not necessary to open the housing.

3.2 Electrical element

Note: The code of every element have been marked on device with adhesive label.

Standard equipment:

H1	Lamp signaling the tripping of the motor protective switch Q1 with lamp holder.	S5	Push-button for tripping the motor protective switch Q1 Contacts: 1 NO + 1 NC with lamp socket (for lamp H1)
K1/K2	Motor contactor for control direction of motor "Raise" (towards position n), K1 close. "Lower" (towards position 1), K2 close. Contacts: 4 NO + 2 NO + 2 NC	S16/S17	Limit switch for position n/position 1, switch on/off control circuit Contact: 1 NC
K3	Brake contactor Contacts: 4 NO + 4 NC	S6/S7	Limit switch for position n/position 1, switch on/off main control circuit Contacts: 3 NC
K20	Intermediate contact Auxiliary relay for step-by-step operation. Contact: 4 NO + 4 NC.	S8	Safety switch for manual operation Contacts: 3 NC
M1	Driving motor Squirrel cage motor Ratings see section 2	S12/S14	Cam switches for control direction towards position 1 /towards position n Contact: 1 NO + 1 NC with common switch-over point.
Q1	Motor protective switch with thermic and magnetic tripping Contacts: 1 NO + 1 NC auxiliary contacts.	S13	Cam switch for step-by-step operation
R1	Heater Resistance 1.5 kΩ	X1/X3	Terminal block for external connection.
S1/S2	Push-button for control rotary direction of motor. Contacts: 1 NO + 1 NC	S38	"Remote" / "local" selector
		X10	Socket (220V.AC.10A)
		K21	Time relay, prevent the continual operation.
		CX	Terminal socket for 19 core signal cable
		COUN	Counter

4. Electrical Operational Principle

4.1 Circuits

The motor drive circuit includes motor circuit (main circuit), control circuit, protective circuit and indication circuit etc (See chagram 5).

4.1.1 Motor circuit

The motor terminals U, V, W are connected to the terminal X1/1, 2, 3 of power supply L1, L2 and L3 via motor contactor K3, K1/K2, limit switch S6/S7, manual protective switch S8 and motor protective switch Q1.

4.1.2 Control circuit

The control circuit is connected to L1, N via terminals 6, 7, with the motor protective switch S8, interconnected so that the control voltage is interrupted when Q1 or S8 is energized.

The tripping circuit of motor protective switch Q1 is interlinked with the control circuit.

The motor protective switch Q1 is provided with a tripping coil which can be energized via pushbutton S5 (on the motor drive unit and in

the control room) and via the safety circuit. The safety circuit consists of switching the cam switches S12, S13, S14 and of auxiliary contacts of motor contactors K1/K2 and K3.

4.1.3 Circuit for indication of the motor protective switch Q1 tripping

This circuit is connected to L1 and N via the terminals X1/18,17. The signaling lamp H1 is installed in the emergency-off push button S5 in the motor drive unit. The auxiliary contact Q1 (43,44) is connected to X1/27,28, which is the captive contact when Q1 is closed.

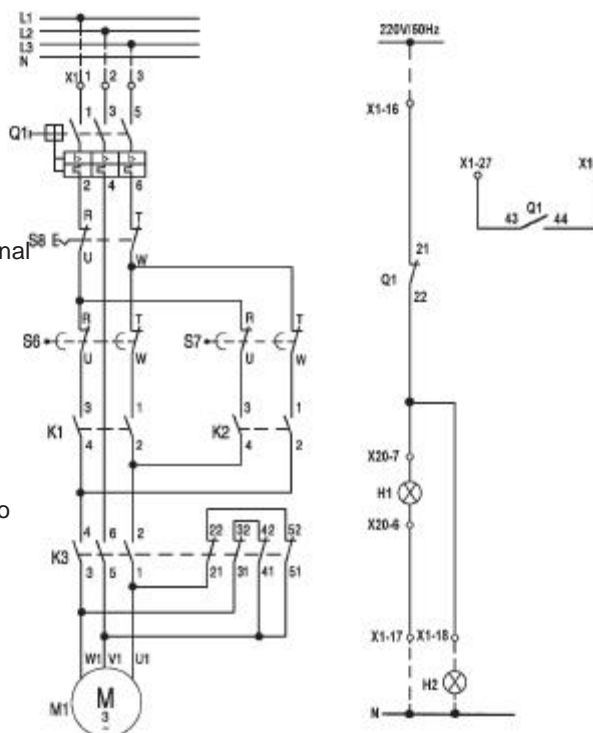


Fig. 4.1.1 Motor circuit

Fig. 4.1.3 Circuit for indicating the tripping of safety switch Q1

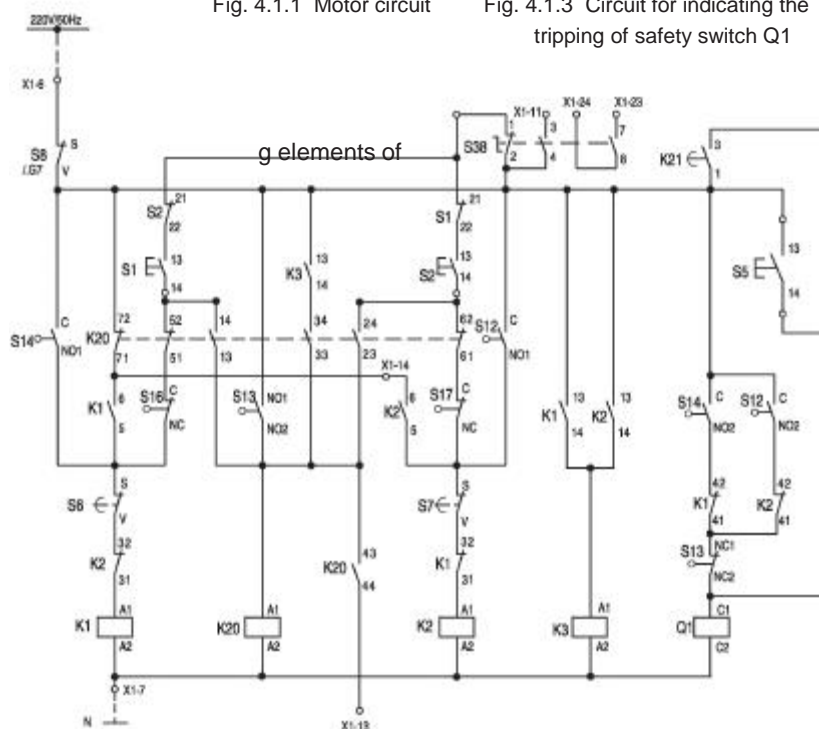


Fig. 4.1.2 Control circuit

4.1.4 Indication circuit of motor operation

The phase voltage of motor M1 is connected to terminals X1/19, 20. Operation indication lamp H3 (inside control chamber). As the captive signal of motor operation, the contact signal integrated by K1 (23,24) K2 (23,24) is connected to X1/25,26.

4.1.5 Indication circuit of remote position

Digital remote position signal transmitter adopts digital slide contact set, the static contact is connected to the terminal on socket via decimal code, the action is operated by means of first open and later close from one position to next position. And integrated with display to display the position parameter (see attached diagram 2).

4.1.6 Heater circuit

The heater circuit is connected to L1, N via the terminals X1/4 and 5.

The heater resistor R1 is connected permanently with power source.

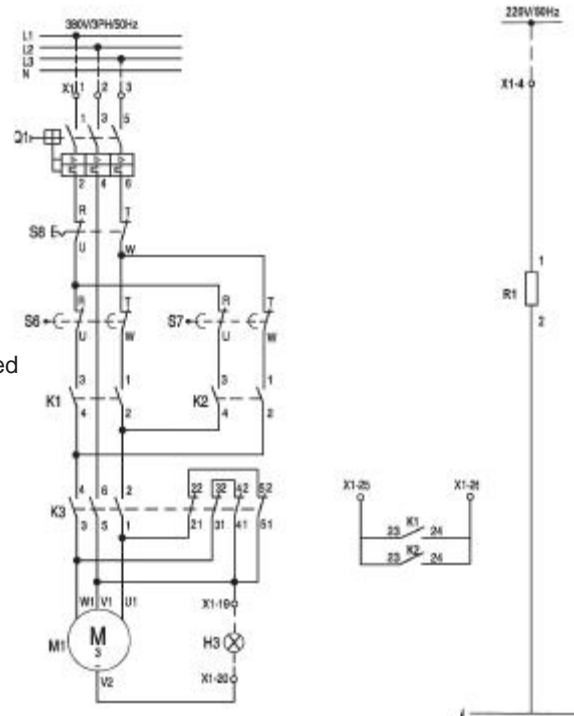


Fig. 4.1.4 Motor operation Indication circuit

Fig. 4.1.6 Heater circuit

4.2 Operation (See appendix diagram 5)

4.2.1 Control

The motor drive control follows the step-by-step principle, i.e. after the initiation the switching operation is automatically and irrevocably accomplished independent of whether the push-buttons S1... S4 have been operated during the running time of the motor drive. (emergency stop is an exception). Another switching operation is only possible when the control system is again in the rest position. The rest position of the cam switches controlling the running period is indicated by red center mark of the tap change indication wheel.

Prerequisite: Motor protective switch Q1 must be closed; the voltage of L1, L2 and L3: AC 380V, 3 phase, 50Hz; Voltage of L1 and N: AC 220V 50Hz, the sequence of phase shall be correct, remote/local control switch S38 should be in position.

Operation: control of transforming towards position n.

4.2.1.1 Start

Press push-button S1, 13-14 of S1 will be closed (21-22 cut-off), meanwhile the current will connect K1 coil from

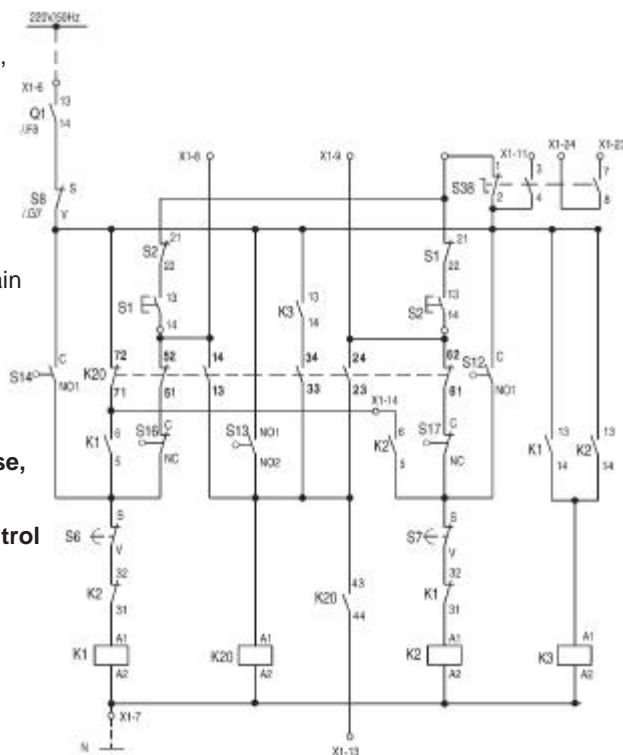


Fig. 4.2.1.1 Start-up

X1/6 via Q (13, 14) !S8(S, V) !S38(1, 2)-S2(21, 22), S1(13,14), K20(52,51),S16(C,NC),S6(S,V), K2(32,31); the contactor K1 will be closed, which will make contact K1(5,6) close, K20 coil will be energized via K20(72, 71), thus the instant action has been completed. When K1 is closed, the contact K1 (13,14) will be closed, which make K3 coil via K1, K3 close, the motor M1 will operate.

4.2.1.2 Step-by-step control:

After motor start working, step position indication wheel will overrun the green field, the cam switch S14(C, NO) will close, the contactor K1(A1, A2) can be energized by S14(C, NO). When motor step position indication wheel revolve another small section, cam switch S13 will start, the closing of S13(NO1, NO2) make the intermediate relay K20 coil close after being energized, K20(52,51), K20(72,71) open, K20(14,13), K20(34,33) close, and K20 is energized via S13(NO1, NO2) and K3(13,14), K20(34, 33), but K1 can keep being energized only via cam contact switch S14(C, NO), S13(NO1, NO2) will be opened before the motor drive stop, and K20 still keep being energized via K3(13,14), K20 (34,33).

4.2.1.3 Stop

When the operation of step 1 has been completed, the cam switch S14(C, NO1) open, K1 release, the contact 13,14 of K1 opens, K3 release and the main circuit opens, motor brake contact 21-22,31-32,41-42, 51-52, self-actuating energy consumption braking, motor M1 stop running. At the same time, K3 is released, the contact 13 and 14 of K3 open,

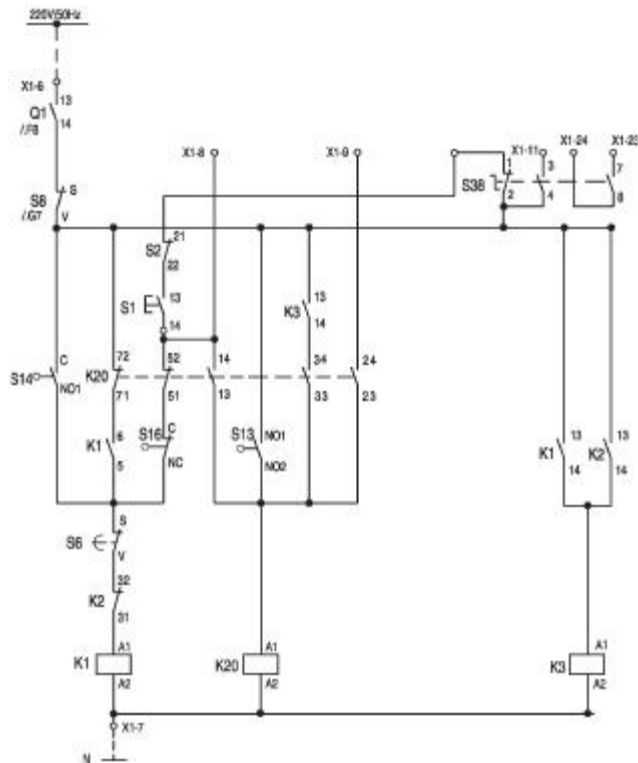
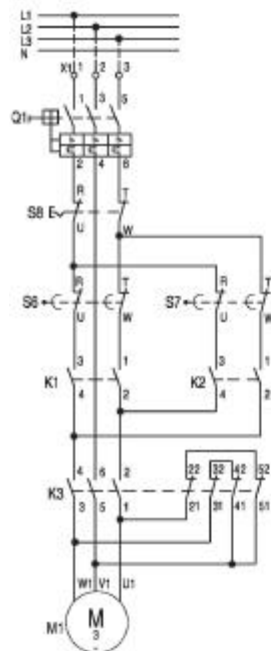


Fig. 4.2.1.2 Step-by-step control

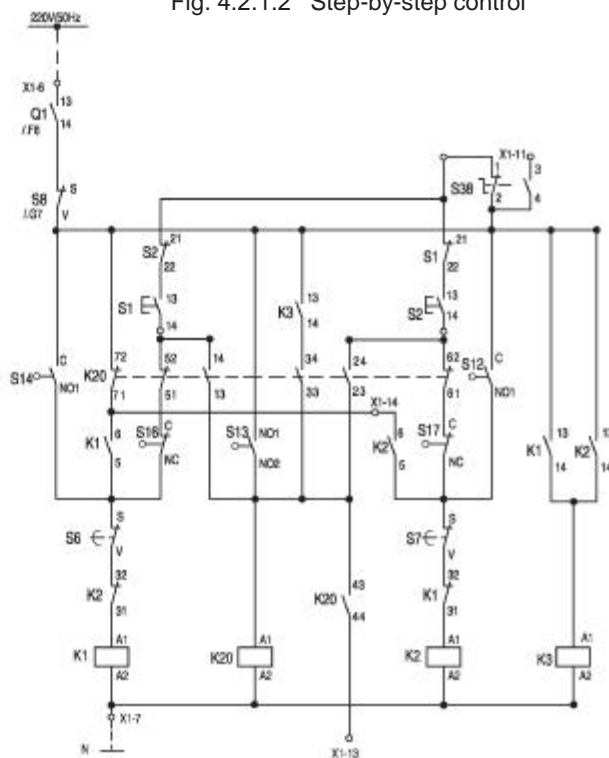


Fig. 4.2.1.3 Stop

which make K20 de-energized.

If pushbutton S1 or S2 has been pressed, K20 will be self-locked via it's contact 13-14 or 23-24 to prevent K1 or K2 from being excited via 51-52 or 61-62 of K20, if the pushbutton S1 or S2 has not been pressed, K20 will be released.

The control of transforming to position 1: press pushbutton S2 contactor K2 is powered and closed! braking contactor K3 is powered and closed !the motor will run reverse !The direction-memory cam switch S12 start up the following control is the same as that of the transforming towards to position n. At the switch action sequence from one tap changer to next tap changer (0-30 block on step progress indication wheel), the operation situation of each control is shown in figure 4.

At the switch action sequence from one tap changer to next tap changer (0-30 block on step progress indication wheel), the operation status of each control element.

The sequence of closing: S1(S2), K1(K2)K3, S14(S12) S13,K20

The sequence of opening: S1 (S2), S13, S14 (S12), K1 (K2), K3, K20.

open main circuit contact R-U, T-W, thus the motor will stop running, and the motor contactor K1 or K2 circuit will be opened via contact S-V.

4.2.3.2 Protection of manual operation

Insert hand crank on shaft, the manual protection switch S8 actuate to cut off motor power supply and control power supply. After manual operation, the hand crank is withdrawn from shaft, manual protection switch S8 is closed again.

Note: To prevent motor drive unit from being initiated automatically, after manual operation, the motor drive

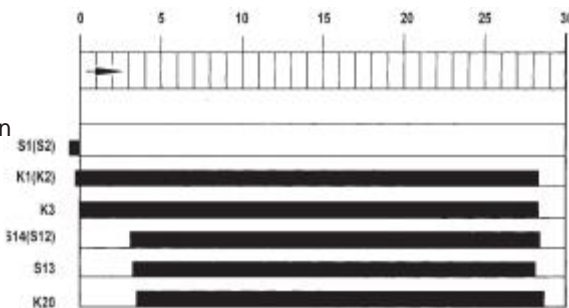


Fig. 4

4.2.2 Skip action performance of middle position

For the switch with middle skip point, the motor drive unit will perform continuous operation by means of the close/open of S37.

4.2.3 Performance of safety protection

4.2.3.1 Protection of limit position

When the motor drive reach limit position, the permanently-closed contact C-CN of limit switch S16 (at position N) or S17 (at position 1) will open, thus contactor K1 or k2 can't be energized any more. When the terminals position is overrun, the limit switch S6 or S7 will

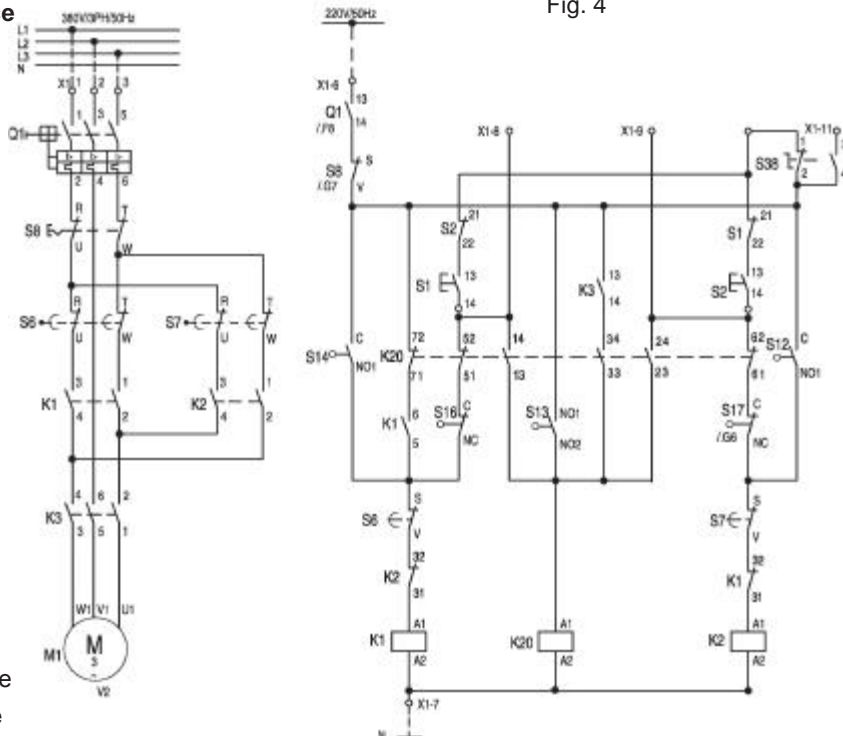


Fig. 4.2.3.1 Limit position protection

unit must be swung into the red line of step progress position indication wheel, outside the red line shall be the rest position of cam switch driven by motor drive unit.

4.2.3.3 Phase sequence protection

To ensure the motor drive unit to revolve according to the preset direction, there are certain requirement for the phase sequence of motor 3 phase power supply, if the phase sequence of terminals L1, L2 and L3 is not correct, the phase sequence protection circuit will make safety switch Q1 trip, see fig 4; when the phase sequence is wrong, press down S1 pushbutton, K1 will close, K1 (41, 42) will open, and the motor will revolve counterclockwise, the motor drive will operate towards the reverse direction to make S12(C, NO2)close, make Q1 release coil energized via K2(41,42), S13(NC1, NC2), safety switch will trip, cut off main circuit and control circuit, the motor will stop running, in this case, the phase sequence shall be adjusted accordingly (any two phase can be interchanged), operation can't be executed until manual operation reach the red line in the center of step-

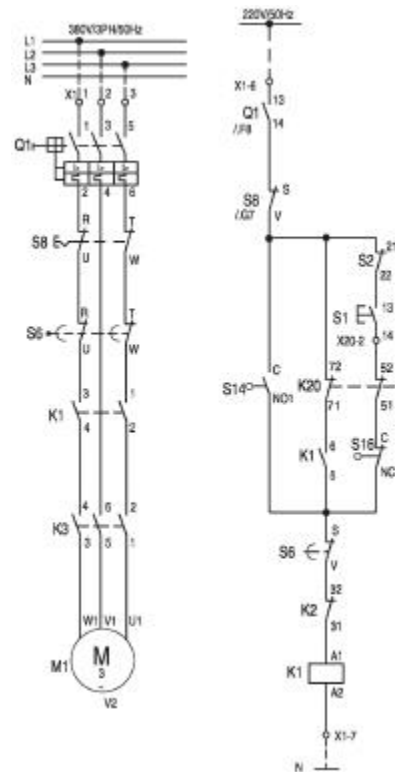


Fig. 4.2.3.2 Manual operation protection

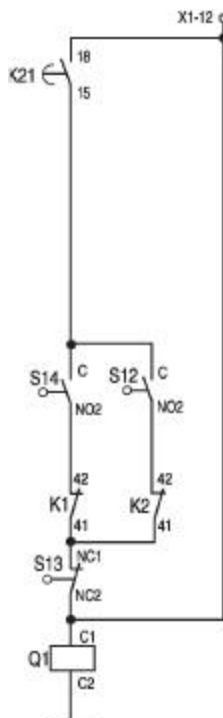


Fig. 4.2.3.3 Phase sequence protection

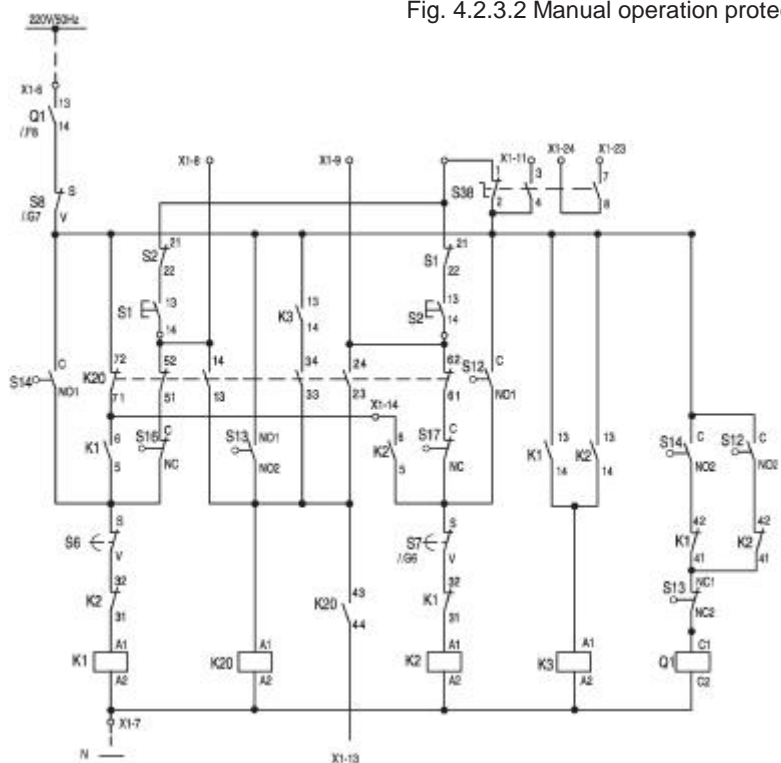


Fig.4.2.3.4 Automatic restart protection after

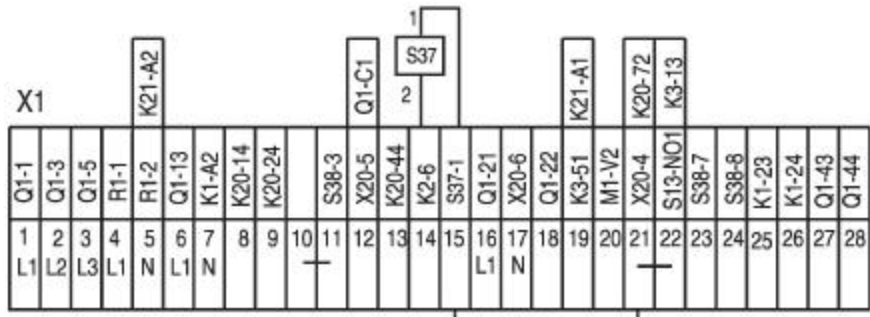


Fig. 4.2.3.8 Step signal captive terminal

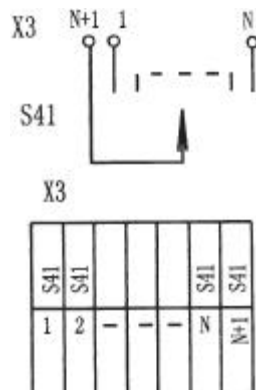


Fig. 4.2.3.7 Connection of external circuitry

diagram.

4.2.3.8 Step signal captive terminals (also called double signal)

Add a group slide contact set on remote position transmitter, the static contact is relative to the position of static contact of position indication circuit, and connected to terminal block X3 according to the sequence from 1 to N; The action contacts start by means of first open and later close from one position to next one. Two groups contacts set keep mechanical sync relative, independent of each other on electrical, thus the signal contact supplied on terminals X3 is a set captive and closed operation position.

5. Installation

5.1 Mounting the motor drive unit to the transformer tank (see appendix, dimension drawing).

The motor drive unit is mounted by means of 4 studs fixed at the sides of transformer tank. The corresponding bore holes are at the external side of the housing of the motor drive. Take care that the motor drive unit is mounted vertical and that its drive shaft is in correct alignment with the shaft of the bevel gear.

If the transformer causes extremely heavy mechanical vibrations, the use of vibration dampening connectors is recommended.

5.2 Coupling of tap changer and motor drive.

It is absolutely necessary that the tap change operation is accomplished before the motor drive stops. This is ensured by setting the time of the selector or diverter switch action at a distinct interval before the end of the motor drive action. This red center mark is used as a reference when

adjusting.

One tap change operation corresponds to one rotation corresponds to one rotation of the indication wheel. The tap change indication wheel is divided into 30 sections with one section corresponding to one rotation of the crank.

The number of sections counted from the beginning of the tap change operation until the red center mark of the indication wheel faces the mark on the inspection window

Example: (See figure 5)

- On-load tap changer now is in operation position 10. Turn crank towards position 11 until the selection switch sound a click, keep cranking it and count the number of section of red line. (Revolutions of hand crank)
- Result: 4 sections
Compare a with b
 $12 - 4 = 8$ sections is more than 3.75 sections
It must be readjusted.
Corrected number of sections $(12 - 4) \div 2 = 4$ sections, choose 3.75 sections.
- Turn crank towards 11 until red center mark appears.
- Uncouple a coupled joint clamp under vertical drive shaft.
- Turn on in the same direction (towards 12) by 3.75 sections.
- Couple again.
- Turn on in the same direction (as with e) until selector switch action occurs. Count number of TIW sections until red center mark appears.
Result: 8.25 sections.
- Check in the opposite direction.
Result: 7.25 TIW sections.
 $8.25 - 7.25 = 1$ less than 3.75 sections
Coupling tap changer-motor drive is sufficiently symmetrical in both directions.

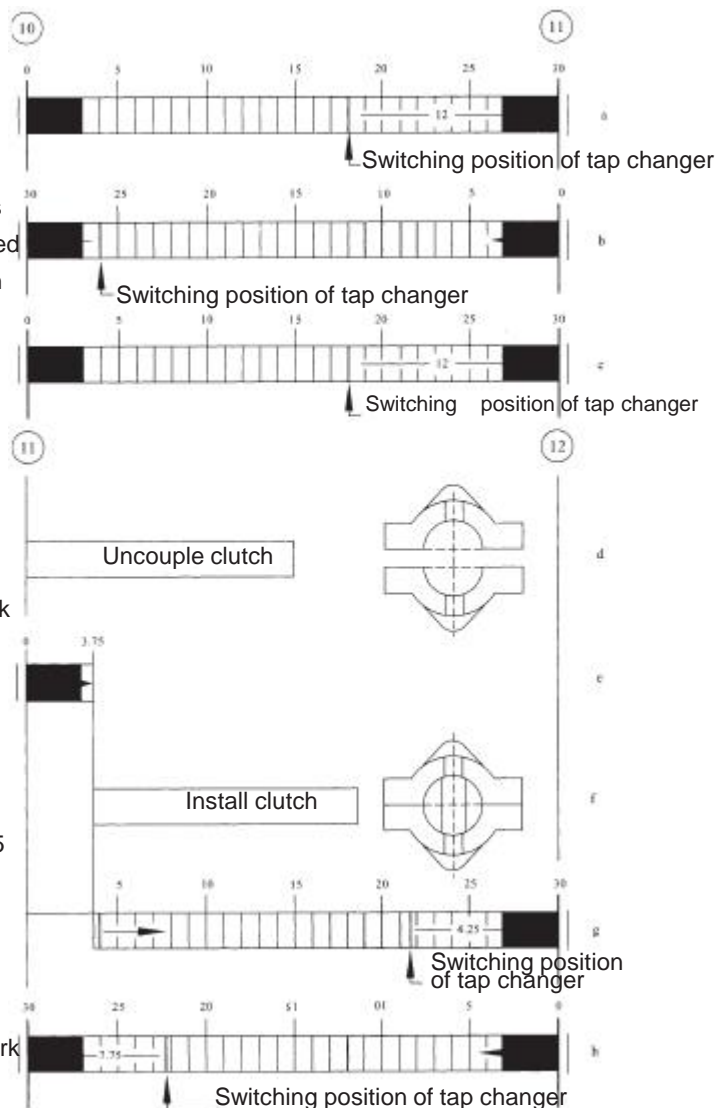


Fig.5

should be equal in both rotation senses. Minor asymmetry is admissible. Symmetrical coupling is achieved as follows:

- Adjustment only with manual operation.
- Tap changer and motor drive have to be in the adjustment position.
- Couple tap changer and motor drive.
- Turn crank in one direction until selector or diverter switch action occurs. Count the remaining TIW sections until the red center mark of the tap change indication wheel is visible in the middle of the inspection window.
- Repeat this procedure in the opposite direction.

-If there is a difference between the numbers of sections counted on both directions, the motor drive must be readjusted in relation to the tap changer by half this difference of numbers.

Notes:

The square shaft tube of the vertical drive shaft can only be coupled to the coupling brackets after a rotation angle of 90°C or multiples. This angle corresponds to 3.75 TIW squares. Readjusting, therefore, becomes necessary only if the difference between clockwise and counter-clockwise cranking is in excess of 3.75 TIW sections.

6. Operational test and adjustment

6.1 Preparations

After the transformer has been put on site, prior to operate the tap changer, the motor drive unit shall be experienced following test:

- . Prior to operate, please be sure to familiar with manual instruction and method of use.
- . Prior to use, check whether the signal of the adjusted position of tap changer, motor drive and the position of remote display (accessories) is identical.
- . Prior to connect to the power supply, check whether the wire connection of all electrical element is loosen, the grounding blot of motor casing should be grounded safely.
- . Prior to operate electrically, check if manual operation by crank is freely operational, the switching position and stop position of tap changer is correct.
- . Under low temperature and humid condition, start the heater for several hours before operation. If the tap changer is transported to on site and stored over two weeks, the resister shall be connected to power supply to avoid and rust dew.

6.2 Electrical operation test

Note: The requirement of operating power supply and phase sequence (See appendix 2) should be followed.

6.2.1 Checking the step-by-step operation

Press down pushbutton S1 or S2 to make motor drive run at clockwise (counter-clockwise), check if driving motor is automatically switched off when the tap changer has

performed one tap change and the red line and digit line will be aligned with reference line when stopped.

During the actual use, the red line on step progress position indication wheel can't be aligned with the reference line, there may exist some deviation between the lines, if they are still within the green field, it won't affect the operation, when the reference line is out of the green field, it should be adjusted, and the method of adjustment are as follows: when motor drive is adjusted up to (down) one step, the red line will appear deviation, one piece on (or under) cam wheel shall be loosen, adjust the angle, which has been adjusted before delivery, user needn't make any further adjustment.

6.2.2 Checking limit position

Conduct the full cycle of tap change until it reaches to the end position and it is impossible to keep electrical operation further more in the same direction, but it's possible in the opposite direction. For the test of another end position, the same procedure is also applied. When the end position is reached, the trip between control and main circuit is achieved by means of the limit stop block on the limit protection gear wheel first trip S16 (or S17) then S6 (or S7). Thus a. Adjust S16 (position n) or S17 (position 1).

- b. Adjust limit stop block.

Make S16 or S17 start running before completing tap change, and S6 or S7 start running only over the end position, It's usually adjusted by factory before delivery user needn't to make any further adjustment.

6.2.3 Manual operation protection test

When inserting hand crank handle, we should hear a sound occurred from protective switch S8, and the operation is impossible by pressing any pushbutton from S1 to S5, if S8 does not act, adjustment is necessary, move it forward to make it start action earlier.

When pull out the hand crank handle, we should hear the sound of S8 restoration, and electrical operation is OK, if S8 can't be restored, we can adjust the clip ring, if S8 itself can't be restored, it must be replaced.

6.2.4 Checking the emergency power supply cut-off

See 4.2.3.5

7. Trouble shooting

7.1 Short circuit of power wire

- External operating power supply itself is faulty.
- Power supply connection is wrong, connection should be made according to the arrangement of terminal block in diagram 4.
- The bridging connection on terminal block is wrong, mostly because the original connection drops off and falsely connected when user make external connection, the bridging should be made correctly according to terminal block in diagram 4.

7.2 The contactor can't be closed even the pushbutton S1 or S2 has been pressed down

(See 4.2.1.1) Remote/local switch position is wrong.

7.2.1 Both direction can't be closed

- The parallel connection wire on terminal block X1 is loose or drop off, which make control out of power supply.
- Circuit breaker Q1 has not been closed.
- Manual protective switch S8 has not been restored or disconnected (See 6.2.3)
- Some connect joint is loose or drop off.
- Remote/local switch position is wrong.

7.2.2 Single direction is not closed

- Pushbutton hasn't been restored, two pushbutton S1 and S2 is interlocked, the invalid action of pushbutton in one direction is usually due to un-restored push button on the other direction.
- Pushbutton itself is failed
- Limit switch S16 (raise) or S7 (lower) has not been restored or disconnected.
- Limit switch S6 (raising) or S7 (lowering) has not been

restored or failed, making S-V contact disconnected.

- The normally-closed auxiliary contact 61-62 of contactor K2 (raising) or S7 (lowering) is disconnected invalid.
- The coil of contact K1 (raising) or K2 (lowering) is broken.
- Some terminal lead of control circuit is loosen or disconnected.

7.3 Contact closed when pressing down S1 or S2, but the motor can't start (see 4.1.1)

- External power supply does not conform to the requirement (see 2)
- Some contact of travel switch S6, S7, S8 or K1, K2, K3 can't be closed normally
- Some connection wire lead of main circuit is loose or disconnected.
- Main motor is broken.

7.4 Pause in the process of operation

- External power supply is blackout.
- The position cam switch S14 (raise) or S12 (lower) is not correctly aligned or its NO contact can't be closed .
- The action sequence of cam switch S12, S13, S14 is wrong, (see 4.2.1.2)
- When motor drive is at limit position, the limit stop block is tend to forward, thus making S6 or S7 is disconnected when the step 1 tap changing has not been completed (see 6.2.2)
- The false connection between motor drive and switch (the step position is not the same) cause mechanical limit position when switch limit position is reached.

7.5 The trip of safety switch Q1

7.5.1 Tripping upon connecting power supply

- a. False connected to permanently-closed inside control chamber of external remote stop pushbutton S9, which should be connected to permanently-opened contact.
- b. Inside 4 and 5 terminal of pushbutton plug-ins has been broken.
- c. Air break switch Q1 itself is malfunction, to replace Q1.

7.5.2 Tripping during operation

- a. The phase sequence of three phase is wrong, the phase protection cause tripping (see 4.2.3.3)
- b. Short circuit between safety switch and some power supply circuit.

7.5.3 Revolve one step, tripping when stopped

- a. The contact releasing of cam switch S12 or S14 is not sync.
- b. The restore force of cam wheel spring is too large, which causing cam wheel knock reverse at cam switch when restoring, and S12 or S14 instant conducted, thus making Q1 trip (see last par. of 4.2.3.3)
- c. The continuous action, time relay action make safety switch trip.

7.6 When stopped, the red line will appear deviation (see 6.2.1)

7.6.1 Deviation of one direction

The cam wheel block is loosen and displaced, readjust cam wheel (see 6.2.1)

7.6.2 Deviation in both directions

- a. Loosen because step progress position indication wheel has not been tighten. Characteristic: position of red line is at random, un-definite.
- b. The poor contact of auxiliary contact (motor short brake contact) of contactor K3 or contactor K3 discharge until there exist delay in release (if coil remain magnet, there will be bur on auxiliary contact). Characteristic: operation in both directions, the red line all beyond the range when stopped.

7.7 Interlocking of motor drive unit

- a. The position of cam switch S13 is too wide, its permanently-opened contact never close during a cycle of transforming operation, thus cause the intermediate relay K20 don't close all the time.
- b. The cam switch S13 is out of effect and its permanently -open contact can't be closed normally.
- c. Contactor K1 (rising) or K2 (lowering) discharge until there exists delay in release.

When next tap changer transforming to S14 (C, NO1) or S12 (C, NO1), It still don't release when close again.

7.8 The motor can run, but step progress indication wheel can't work

The fan block screw on step progress indication wheel shaft is broken.

7.9 Limit protection is invalid (See 6.2.2)

7.10 Once power on, the pushbutton hasn't be pressed, but the motor drive unit will go up (go down) one step automatically, and the intermediate relay K20 don't release when stopped.

- a. 1,2 terminal (up) or 3,4 (down) of pushbutton plug-ins has been broken via.
- b. The external remote control pushbutton S3 (up) or S4 (down) is improperly connected to normally-close contact, it should be connected to normally-open contact.

7.11 No indication on indicator

7.11.1 No indication in overall indicator

- a. 220V power supply has not been provided.
- b. The switch key of indicator has not been switched on.
- c. The cable from motor drive unit to control chamber has not been connected or the plug-ins on both end hasn't been tighten.
- d. When user add cable, the position indication share terminal has been connected.
- e. The plug of plug-ins is not suitable for the arrangement of socket tube.
- f. The indicator is broken.

7.11.2 No indication for specific step

- Poor contact of slide contact set
- The lead wire of contact set contact is false-welded or broken.
- Some cable lead wire connection is missing

7.12 The step of indication doesn't correspond to that of site position indication wheel

7.12.1 Specific step is not corresponding.

- The cable lead wire is improperly connected.
- The lead wire of contact set contact is falsely soldered.

7.12.2 All steps are indicated incorrectly

Loosen and displaced between the shaft of contact arm and coupler.

8. HMC-3C Position Indicator For On Load Tap Changer

8.1 Introduction of performance

HMC-3C type on-load tap changer position indicator can be used for the remote indicator provided that it is combined with remote position indication circuit (4.1.5) of motor drive unit. It also has the function of "raise" "stop" "lower" for tap changer, with remote indicator lamp.

HMC-3C indicator adopts integrated circuit control, LED digital tube indication, which boasts high stability and reliability; its plastic housing is lightweight, small volume, safe and easy to use.

8.2 Technical data

- Operating voltage : ~220V/AC
- Operating frequency: 50Hz/60Hz

- Max. indication steps: 39 steps
- Operating temperature: -10°C~40°C
- Hole dimension: width×height×depth
=150×75×166(mm³)
- Weight: about 0.85kg

8.3 How to connect

- Connect one end of cable of indicator to socket under the bottom of motor drive unit box. The other end should be connected to the socket at the back side of display. Attention: securely fasten to obtain good contact.
- Connect operation command terminals
- Connect operating voltage terminals to AC 220V.
- Press the button of power supply, it can be put into operation.

Terminal of indicator HMC-3C	Motor Drive unit CMA7/CMA9	Remarks
1	8	1→N
2	12	Stop
3	9	N→1
4	11	Common
5	23	Remote control indication
6	24	

Cable terminal connect to the back of indicator.



9. Optional accessories

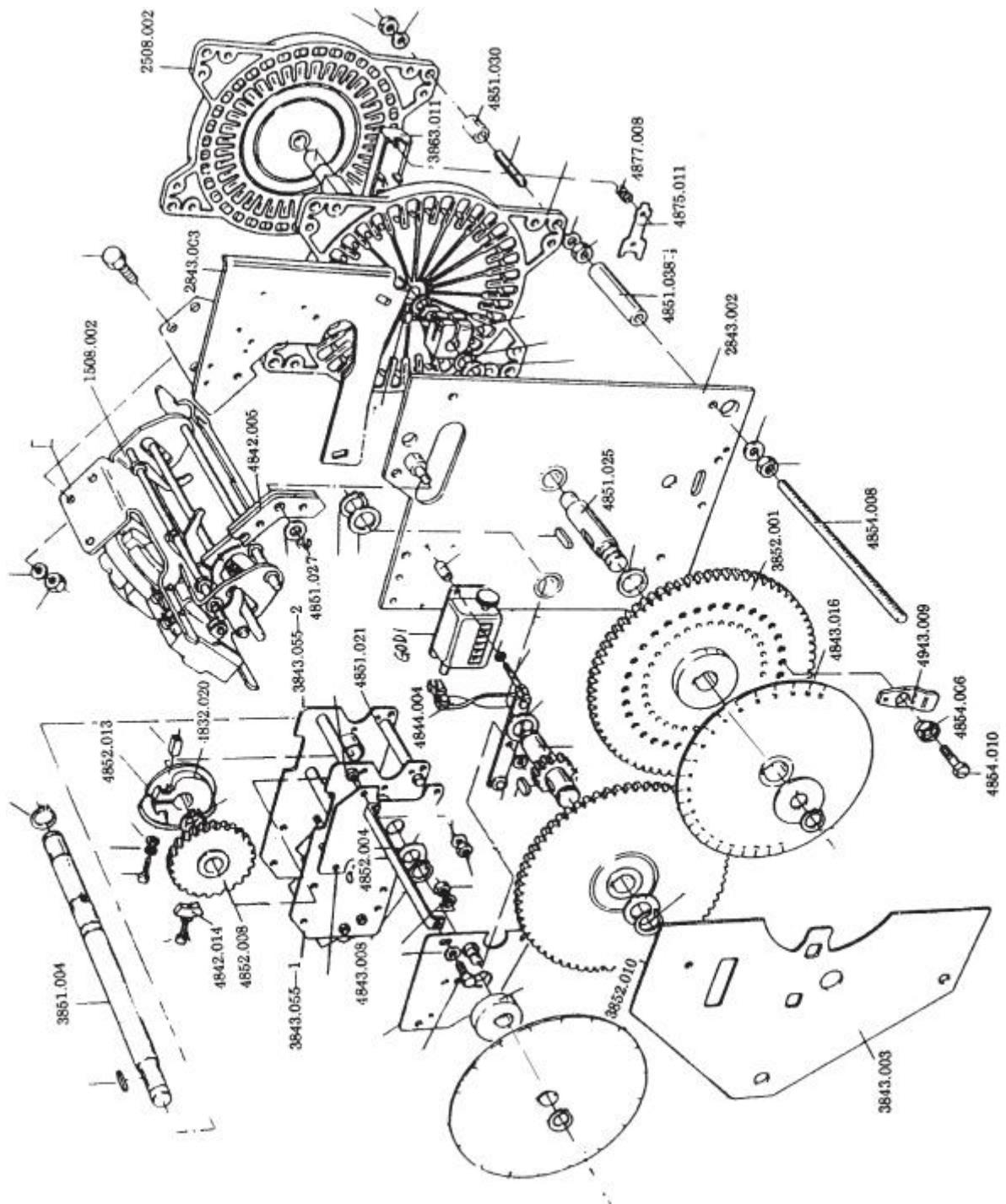
Performance introduction of HMK-2A type on-load voltage-regulating tap changer automatic controller

HMK-2A tap changer automatic controller can be used for the manual or automatic control of transformer on-load voltage-regulating. If the actual voltage of HMK-2A (from PT at second side) compare with the set voltage, once the voltage deviate from preset range, it will produce a “1→N” or “N→1” control signal, thus making on-load tap changer move from one tap position to next one. HMK-2A has unique three ways of voltage indication, which can display signal voltage, upper limit voltage

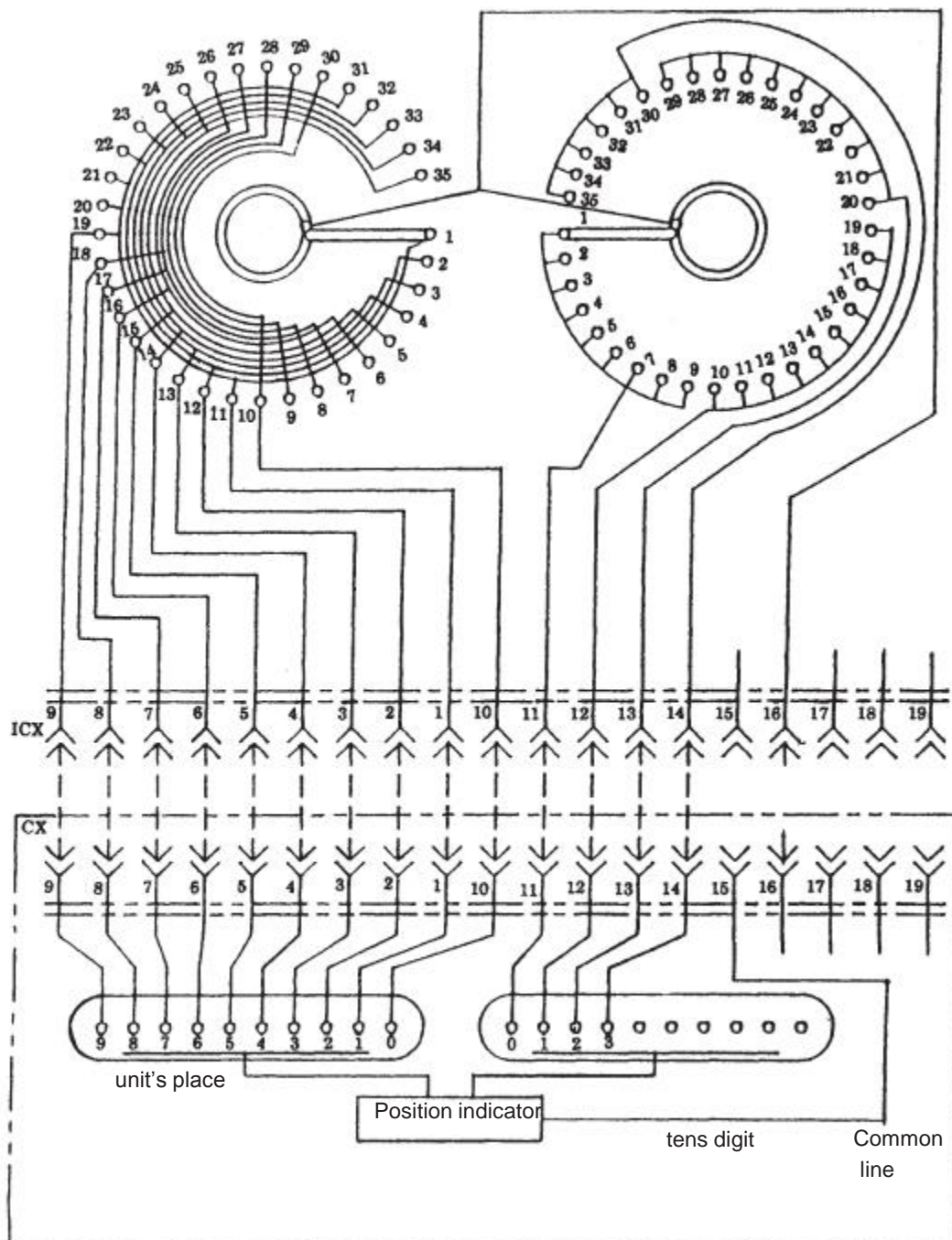
(lower voltage), lower limit voltage (rise voltage); Position indication can display the tap position of tap changer; The setting of voltage can be set to the users' desired range; The adjustment range of relay should be 20~180S. HMK-2A is also supplied with the function of locking “over-voltage” and “under-voltage”, thus, if there exist any trouble in power network, HMK-2A will lock automatically, and the capacity of controller getting rid of trouble is greatly enhanced. HMK-2A also has the function of alarming of over-voltage or under voltage.

HMK-2A has the function of over-current blocking and resistance-compensating.

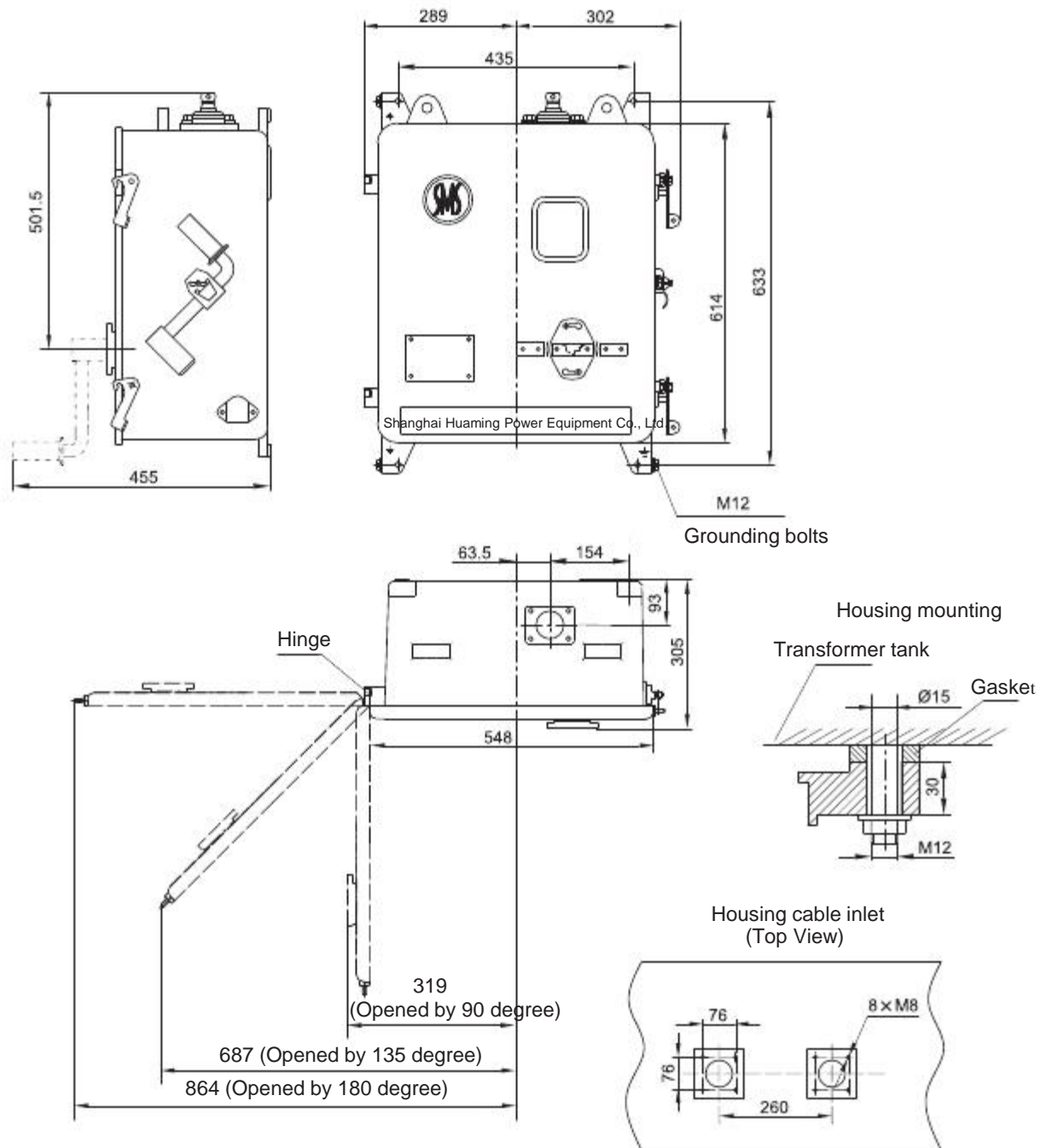
Appendix 1 Exploded view of mechanical control system



Appendix 2 Connection diagram of position indication



Appendix 3 Overall dimension diagram of CMA 9 motor drive unit



Unit:mm

Appendix 5 Explanation of terminal X1 and X3

Explanation of X1 terminal

X1Terminal No.	Explanation
1,2,3,5	Power supply input, voltage of L1, L2 and L3: 380V/50Hz Voltage of L1 and N: 220V/50Hz
8	For remote control "raise" command input
9	For remote control "lower" command input
10,11	Shared by remote control command.
12	For remote control "stop" command input
18	For emergency trip signal output (output 220V/50Hz power signal)
19,20	For motor operation signal output (output 220V/50Hz power signal)
23,24	"Remote control/local" change over switch, for "remote control" status signal output (output captive signal)
25,26	For motor operation signal output (output captive signal)
27,28	For safety switch "close" status signal output (output captive signal)

Explanation of X3 terminal:

The signal provided by X3 is a set of one to one corresponding captive signal, among them, X3-N+1 is step common terminal, X3-1 to X3-N corresponds to step 1 to N of tap changer.

Appendix 6 Explanations of CX terminals

CX output decimal position signal, CX is generally connected to HMC-3C position indicator.

CX Socket No.	Explanations
CX-1	Tap changer position signal unit's place "1"
CX-2	Tap changer position signal unit's place "2"
CX-3	Tap changer position signal unit's place "3"
CX-4	Tap changer position signal unit's place "4"
CX-5	Tap changer position signal unit's place "5"
CX-6	Tap changer position signal unit's place "6"
CX-7	Tap changer position signal unit's place "7"
CX-8	Tap changer position signal unit's place "8"
CX-9	Tap changer position signal unit's place "9"
CX-10	Tap changer position signal unit's place "0"
CX-11	Tap changer position signal tens digit "0"
CX-12	Tap changer position signal tens digit "1"
CX-13	Tap changer position signal tens digit "2"
CX-14	Tap changer position signal tens digit "3"
CX-15	Tap changer position signal common terminal
CX-16	Tap changer position signal indicator light common terminal
CX-17	"1→N" indication
CX-18	"N→1" indication
CX-19	"Stop" indication

NOTICE TO USE AND ORDER

Customer and end-user should record the operation and inspection of the tap changer. In case of special condition, please contact with us and give us your report for data collecting purposes that we can give you possibly further recommendations for your next inspection.

After the OLTC sold out from the factory within 18 months, in case of any damage or malfunction of the OLTC due to the manufacturing quality encountered by the customer or end-user under the regulations of storage and application, we can give you inspection and repair work without charges.

Generally the provided cable lead for the indicator is 30M. Please specify your special requirement when you give your order.

WARMLY WELCOME YOU TO GIVE US COMMENT AND SUGGESTION FOR OUR PRODUCTS. THANK YOU FOR YOUR SUPPORT AND COORDINATION.

WE WOULD LIKE TO PROVIDE OUR CUSTOMER WITH HIGH QUALITY PRODUCT, EXCELLENT SERVICE AND PREFERENTIAL PRICE.



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