



## Installation Instructions for Series C F-Frame Motor Circuit Protector Type HMCP & HMCPS



### WARNING

DO NOT ATTEMPT TO INSTALL OR PERFORM MAINTENANCE ON EQUIPMENT WHILE IT IS ENERGIZED. DEATH, SEVERE PERSONAL INJURY, OR SUBSTANTIAL PROPERTY DAMAGE CAN RESULT FROM CONTACT WITH ENERGIZED EQUIPMENT. ALWAYS VERIFY THAT NO VOLTAGE IS PRESENT BEFORE PROCEEDING WITH THE TASK, AND ALWAYS FOLLOW GENERALLY ACCEPTED SAFETY PROCEDURES.

CUTLER-HAMMER IS NOT LIABLE FOR THE MISAPPLICATION OR MISINSTALLATION OF ITS PRODUCTS.

### 1. INTRODUCTION

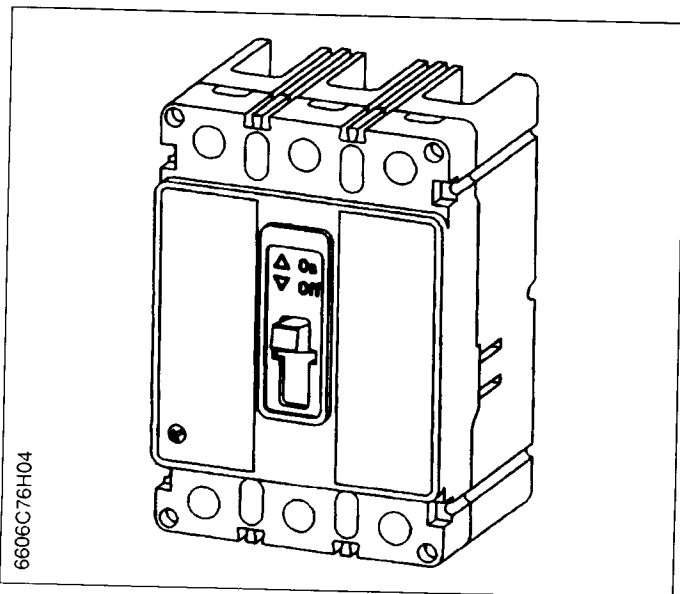


Fig. 1-1 F-Frame Series C Motor Circuit Protector

The user is cautioned to observe all recommendations, warnings, and cautions relating to the safety of personnel and equipment as well as all general and local health and safety laws, codes, and procedures.

The recommendations and information contained herein are based on Cutler-Hammer experience and judgement, but should not be considered to be all-inclusive or covering every application or circumstance which may arise. If any questions arise, contact Cutler-Hammer for further information or instructions.

### General Information

The F-frame Series C instantaneous-only (magnetic) motor circuit protector (MCP) (Fig. 1-1) is available in ratings from 3A to 150A continuous current for motor starter sizes 0 through 4. Designated as the Type HMCP and HMCPS, it is available in 3-pole frames only. The MCP is designed to comply with the applicable requirements of Underwriters Laboratories, Inc. Standard UL489 and the International Electrotechnical Commission Recommendations No. IEC 947.

The MCP is a UL recognized component under file E7819. It is used primarily to provide short-circuit protection as part of a combination controller where other circuit protective functions are performed by other devices within the controller. **The MCP is not suitable for reverse feed applications. For more information, see Frame Book 29-111.**

This instruction leaflet (IL) gives procedures for installation, operation, inspection, and checking of F-frame MCPs by the end user.

Conforming to N.E.C. requirements, the maximum HMCP and HMCPS trip ampere value is set by the motor FLA. Since there are various types and classes of motor designs (based on duty cycle, electrical load, and manufacturer's discretion), locked rotor currents (and resulting in rush current magnitudes) vary. These are normally identified by N.E.C. codes. The listed HMCP and HMCPS trip ampere value is considered typical, but not all inclusive. This is the reason for the adjustable magnetic trip setting, which compensates for different actual motor in rush currents. Trip level adjustments are normal and sometimes necessary to enable the motor to start without nuisance tripping, especially when motor or system conditions induce higher than expected in rush currents. These circumstances may be beyond the control of the HMCP and HMCPS, relative to its allowable trip setting. Such conditions should be treated as a special case which may be referred to Cutler-Hammer.

## 2. INSTALLATION

The installation procedure consists of inspecting and mounting the MCP, connecting and torquing the line and load terminations, and attaching terminal shields or barriers, when required. To install the MCP, perform the following steps:

**F-Frame MCPs are factory sealed. UL489 requires that internal accessories be installed at the factory. Where local codes and standards permit and UL component recognition is not required, internal accessories can be field installed. Accessory installation should be done before the MCP is mounted and connected. The MCP has a cover interlock which requires the handle to be in the OFF position when removing or installing the cover.**

If the HMCP or HMCPs is opened at locations other than authorized, the side located adhesive seal must be removed and the 'UR' nameplate mark must be covered. Both of the above steps are required to comply with UL requirements.

No internal maintenance, adjustments, or replacement items are authorized. Misuse, mishandling, or unauthorized adjustments can change the operating characteristics of the HMCP or HMCPs.

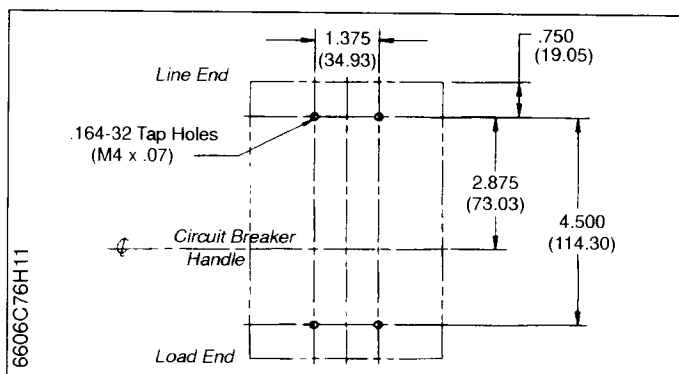


Fig. 2-1 MCP, HMCP and HMCPs Mounting Bolt Drilling Plans

Mounting hardware and unmounted accessories (where required) are supplied in separate packages.

- 2-1. Make sure that the MCP is suitable for the intended installation by comparing nameplate data with system requirements. Inspect the MCP for completeness and damage before mounting.



### WARNING

**BEFORE MOUNTING THE MCP IN AN ELECTRICAL SYSTEM, MAKE SURE THE MCP IS SWITCHED TO THE OFF POSITION AND THAT THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY.**

- 2-2. To mount the MCP, perform the following steps:

**Note: If terminal shield or interphase barriers are to be installed on the MCP, install them after the terminals are connected.**

- a. For individual mounting panels, make sure that mounting panel is predrilled using drilling plan (Fig. 2-1)
  - b. If MCP includes factory installed internal accessories, make sure accessory wiring can be reached when the MCP is mounted.
  - c. Position MCP on mounting surface.
  - d. Install mounting screws, washers, and nuts. Tighten screws firmly, but do not exceed 28 pound-inches (3.16 N.m)
- 2-3. If an optional terminal end cover is to be installed with the MCP (usually line end only), it must be positioned before cable is connected to terminals.



### CAUTION

**WHEN ALUMINUM CONDUCTORS ARE USED, THE APPLICATION OF A SUITABLE JOINT COMPOUND IS RECOMMENDED TO REDUCE THE POSSIBILITY OF TERMINAL OVERHEATING. TERMINAL OVERHEATING CAN CAUSE DAMAGE TO THE MCP.**

- 2-4. After mounting the MCP, line and load cables and accessory leads should be connected. (See accessory schematic diagram on side of MCP.)
- 2-5. If required, install terminal shield on MCP cover with mounting screws provided.
- 2-6. If required, install interphase barriers by sliding barriers into dovetail grooves between terminals.
- 2-7. After the MCP is installed, check all mounting hardware and terminal connecting hardware for correct torque loading. Torque values for lineload terminals are given in Tables 2-1 and 2-2 and on the MCP nameplate.

TABLE 2-1. TERMINAL TYPES

Terminal Catalog Number	Terminal Body Material	Screw Head Type	AWG Wire Range	Metric Wire Range	Wire Type	Torque Value Lb. In. (N•m)
3TA225FD <sup>(1)</sup>	Aluminum	3/16 Socket Hex	#4-4/0	25-95	Cu/Al	120 (13.6)
3TA225FDM <sup>(1)</sup>	Aluminum	5mm Socket Hex	#4-4/0	25-95	Cu/Al	120 (13.6)
3TA225FDK <sup>(1)(2)</sup>	Aluminum	5/16 Socket Hex	#6-300	16-150	Cu/Al	275 (31)
3TA100FD <sup>(1)</sup>	Aluminum	Slotted	#14-1/0	2.5-50	Cu/Al	See Table 2-2
3TA50FB <sup>(1)</sup>	Aluminum	Slotted	#14-#4	2.5-16	Cu/Al	See Table 2-2
3T100FB <sup>(1)</sup>	Steel	Slotted	#14-1/0	2.5-50	Cu/Al	See Table 2-2
3T150FB <sup>(1)</sup>	Stainless Steel	Slotted	#4-4/0	25-95	Cu Only	See Table 2-2

Note: Terminal wire connectors are UL listed for standard wire sizes as defined in UL 486A and UL 486B.

(1) Package of three

(2) Individual terminal identified as TA225FD1

TABLE 2-2. TERMINAL TORQUE VALUES FOR SLOTTED HEAD

Metric Wire Range	Torque Value, N•m	AWG Wire Range	Torque Value, Lb. In.
2.5-6	3.96	#14-#10	35
10	4.52	#8	40
16-25	5.09	#6-#4	45
35-95	5.65	#3-4/0	50

TABLE 2-3. BOLTED CONNECTIONS (KEEPER NUT OR END CAP)

Termination Catalog Number	Screw Head Type	Nut Thread Size	Torque Value, Lb. In. (N•m)
KPR1A / KPR1AM	User Supplied	10-32 / M5	35 (4.0)
KPEKxxx	Slotted	10-32 / M5	35 (4.0)

### 3. MANUAL OPERATION

The MCP is manually operated by the handle or the PUSH-TO TRIP button. The MCP handle has three indicating positions, two of which are shown on the cover by raised lettering to indicate ON and OFF. On the sliding handle barrier, ON, OFF, and trip are also shown by a color-coded strip for each MCP handle position: red for ON, white for tripped, and green for OFF. On the sliding handle barrier, ON/OFF is also indicated by the international symbols I/O. (See Fig. 3-1.)

#### Circuit Breaker Reset

After tripping, the MCP is reset by moving the MCP handle to the extreme OFF position.

#### PUSH-TO-TRIP Button

The PUSH-TO-TRIP button checks the tripping function and is used to periodically exercise the operating mechanism. The button is designed to be operated by using a small screwdriver.

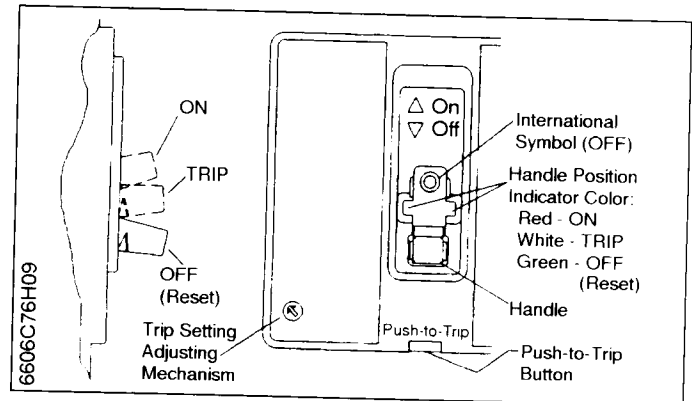


Fig. 3-1 Frame MCP Manual Controls

#### Adjustment of Trip Setting

The trip setting adjusting mechanism permits the MCP trip range to be changed. The mechanism consists of a cam with eight positions for different trip levels. The trip levels are labeled A through H. Trip values are shown on the MCP cover nameplate and in Tables 3.1 and 3.2. To adjust the trip level, perform the following steps:

- 3-1. Determine the motor locked rotor current from the motor nameplate. Refer to Table 3-1 and select appropriate MCP trip setting. Depress and rotate adjustment button clockwise to the setting.



#### CAUTION

A ROTATION STOP PREVENTS THE ADJUSTMENT BUTTON FROM BEING ROTATED COUNTER - CLOCKWISE BEYOND POSITION A. THE MCP CAN BE DAMAGED IF THE BUTTON IS FORCED PAST A IN THE COUNTER-CLOCKWISE DIRECTION.

- 3-2. For closest protection, turn the adjustment button counterclockwise to successively lower settings until the MCP trips when the motor is started. When this setting has been determined, turn the adjustment button clockwise to the next highest setting. The MCP is now adjusted for normal operation.
- 3-3. If the MCP does not trip at the lowest setting (A), leave the adjustment button at this position.

TABLE 3-1: MCP TRIP SETTINGS

Cam Set- ting	Typical Motor Full Load Current Amperes <sup>①</sup>		NEMA Starter Size	Contin- uous Amps	MCP Catalog Number	MCP Trip Setting ②
A	.69	- .91				9
B	.92	- 1.0				12
C	1.1	- 1.2				15
D	1.3	- 1.5	0	3	HMCP003A0 or HMCP003A0	18
E	1.6	- 1.7				21
F	1.8	- 1.9				24
G	2.0	- 2.2				27
H	2.3	- 2.5				30
A	1.5	- 2.0				21
B	2.1	- 2.5				28
C	2.6	- 3.1				35
D	3.2	- 3.6	0	7	HMCP007C0 or HMCP007C0	42
E	3.7	- 3.9				49
F	4.3	- 4.7				56
G	4.8	- 5.2				63
H	5.3	- 5.7				70
A	3.4	- 4.5				45
B	4.6	- 5.6				60
C	5.7	- 6.8				75
D	6.9	- 7.9	0	15	HMCP015E0 HMCP015E0	90
E	8.0	- 9.1				105
F	9.2	- 10.3				120
G	10.4	- 11.4				135
H	11.5	- 12.6				150
A	6.9	- 9.1				90
B	9.2	- 11.4				120
C	11.5	- 13.7				150
D	13.8	- 16.0	1	30	HMCP030H1 HMCP030H1	180
E	16.1	- 18.3				210
F	18.4	- 20.6				240
G	20.7	- 22.9				270
H	23.0	- 25.2				300
A	11.5	- 15.2				150
B	15.3	- 19.1				200
C	19.2	- 22.9				250
D	23.0	- 26.8	2	50	HMCP050K2 HMCP050K2	300
E	26.9	- 30.6				350
F	30.7	- 34.5				400
G	34.6	- 38.3				450
H	38.4	- 42.1				500

TABLE 3-1: MCP TRIP SETTINGS (CONTINUED)

Cam Set- ting	Typical Motor Full Load Current Amperes <sup>①</sup>		NEMA Starter Size	Contin- uous Amps	MCP Catalog Number	MCP Trip Setting ②
A	16.1	- 21.4				210
B	21.5	- 26.8				280
C	26.9	- 32.2				350
D	32.3	- 37.5	2	70	HMCP070M2	420
E	37.6	- 42.9				490
F	43.0	- 48.3				560
G	48.4	- 53.7				630
H	53.8	- 59.1				700
A	23.0	- 30.6				300
B	30.7	- 38.3				400
C	38.4	- 46.0				500
D	46.1	- 53.7	3	100	HMCP100R3 HMCP100R3	600
E	53.8	- 61.4				700
F	61.5	- 69.1				800
G	69.2	- 76.8				900
H	76.9	- 84.5				1000
A	34.6	- 46.0				450
B	46.1	- 57.5				600
C	57.6	- 69.1				750
D	69.2	- 80.6	4	150	HMCP150T4 HMCP150T4	900
E	80.7	- 92.2				1050
F	92.3	- 103.7				1200
G	103.8	- 115.2				1350
H	115.3	- 126.7				1500
A	57.0	- 75.0				750
B	76.0	- 95.0				1000
C	96.0	- 114.0				1250
D	115.0	- 130.0	4	150	HMCP150U4 HMCP150U4	1500
E	③					1750
F	③					2000
G	③					2250
H	③					2500

**TABLE 3-2: SPECIAL APPLICATION MCP TRIP SETTINGS**

Cam Setting	Continuous Ampere Rating	MCP Catalog Number	MCP Trip Setting <sup>②</sup>
A	25A	HMCP025D0	40
B			43
C			46
D			49
E			52
F			55
G			58
H			60
A	50A	HMCP050G2	80
B			87
C			93
D			98
E			103
F			109
G			115
H			120
A	70A	HMCP070J2	115
B			122
C			130
D			139
E			145
F			153
G			160
H			170
A	100A	HMCP100L3	160
B			174
C			185
D			196
E			207
F			218
G			229
H			240

- ① Motor FLA ranges are typical. The corresponding trip setting is 13 times the FLA value shown. The  $\pm 20\%$  trip tolerance can affect trip response and require increase in cam setting per para 3-2.
- ② For dc applications, actual trip levels may exceed the values shown by as much as 100%. Actual dc trip values are application dependent.
- ③ Settings above 130 amps are for special applications. N.E.C. Article 430-110(a) requires the ampere rating

of the disconnecting means to be not less than 115% of the motor full load ampere rating.

#### 4. INSPECTION AND FIELD CHECKS

Series C molded case MCPs are designed to provide years of almost maintenance-free operation. The following procedure describes how to inspect and test a MCP in service.

##### Inspection

MCPs in service should be inspected periodically. The inspection should include the following checks:



#### WARNING

**BEFORE INSPECTING THE MCP IN AN ELECTRICAL SYSTEM, MAKE SURE THE MCP IS SWITCHED TO THE OFF POSITION AND THAT THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY.**



#### CAUTION

**MAKE SURE THAT CLEANING AGENTS OR SOLVENTS USED TO CLEAN THE MCP ARE SUITABLE FOR THE JOB. SOME COMMERCIAL CLEANING AGENTS WILL DAMAGE THE NAMEPLATES OR MOLDED PARTS.**

- 4-1. Remove dust, dirt, soot, grease, or moisture from the surface of the MCP using a lint-free dry cloth, brush, or vacuum cleaner. Do not blow debris into MCP. If contamination is found, look for the source and eliminate the problem.
- 4-2. Switch MCP to ON and OFF several times to be sure that the mechanical linkages are free and do not bind. If mechanical linkages are not free, replace MCP.
- 4-3. Press the PUSH-TO-TRIP button to mechanically trip the MCP. Trip, reset, and switch MCP ON several times. If mechanism does not reset each time the MCP is tripped, replace the MCP.
- 4-4. Check base, cover, and operating handle for cracks, chip ping, and discoloration. MCPs should be replaced if cracks or severe discoloration is found.

- 4-5. Check terminals and connectors for looseness or signs of overheating. Overheating will show as discoloration, melting, or blistering of conductor insulation, or as pitting or melting of conductor surfaces due to arcing. If there is no evidence of overheating or looseness, do not disturb or tighten the connections. If there is evidence of overheating, terminations should be cleaned or replaced. Before reenergizing the MCP, all terminations and cable should be refurbished to the condition when originally installed.
- 4-6. Check MCP mounting hardware; tighten if necessary.
- 4-7. Check area where MCP is installed for any safety hazards including personal safety and fire hazards. Exposure to certain types of chemicals can cause deterioration of electrical connections.

#### **Field Testing**

Any field testing should be done in accordance with NEMA Standards Publication AB2-1984.