Hoffman Controls

Installation & Operating Instructions

610-012A Series

Overcurrent Motor Protector with Single & 3∅ Motors

General

The 610-012A Motor Protector offers the latest technology for providing positive and accurate overcurrent motor (load) protection. Motor protection is accomplished by monitoring and integrating the operating currents with current transformers in each phase of the load. The unique design offers integration of sensed overload conditions that occur as a result of electrical and mechanical overload abnormalities. Fail-safe operation is provided by protecting from excessive current in one or more of the following individual or collective overload conditions:

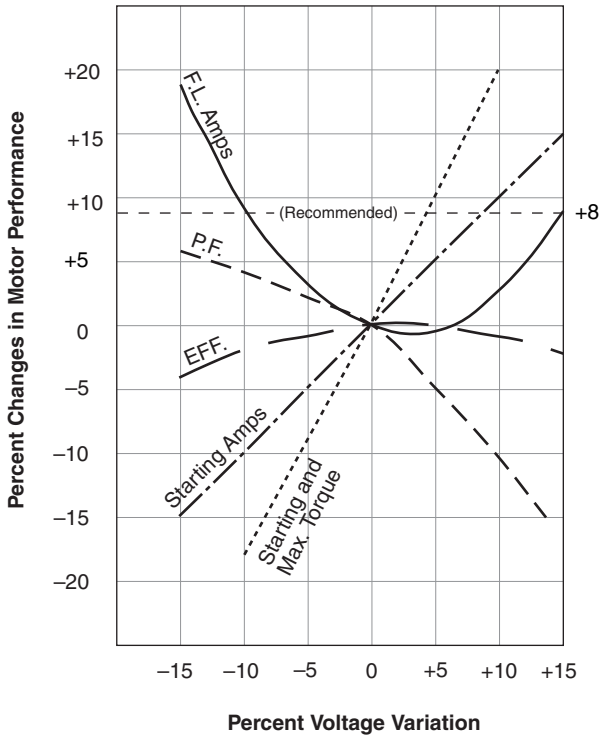
Electrical Overcurrent	Mechanical Overload
Single Phase	Wear
Phase Imbalance	Binding
Low/High Voltage	Friction
Locked Rotor	Stall
Power Factor	Torque

Selecting protection (overload) at 8% above nominal FLA (recommended) will provide both low and high voltage protection indirectly. (See Figure 1, "Effects of Voltage Variation on Induction Motor Characteristics".) Other current conditions will be protected directly by sensing current.

Important: This I&O Instruction only addresses "Across the Line" motor protection. For "Part Winding Motor" protection see Form # 173-0207-001.

Specifications

Voltage, Input (Select)	24, 120 or 208/240V AC
Power	2.5 VA
Frequency	60 Hz
Response Time To Trip	
Minimum	2 Sec. @ LRA
Maximum	20 Min. @ 1.02% FLA
Trip Current Range	
Min./Max.	20/175 Amps
Trip Level Setting	Adjustable
Setting Range	0.2%
Trip Level Repeat Accuracy	± 1%
Relay Rating	
Volts	24 to 240V AC
Current (Max.)	4 Amps
Ambient Temperature Range	
Operating	–30°C/65°C
Storage	–30°C/65°C
Dimensions (L x W x H)	5.56" x 3.32" x 1.3"



Effects of Voltage Variation on Induction Motor Characteristics
Figure 1

Special Features

FAIL-SAFE — This instruction provides the installer with the ability to prove that fail-safe motor protection is properly functioning before the installer sets the required "trip level". This procedure assures the Controller has been properly installed/wired and functions in a fail-safe mode. This assurance is important when the protection of a motor or load is vital to the operation of a system.

ACCURACY — A Standard Calibration procedure is detailed on page 3 of this document. The Controller is capable of accuracy as precise as the test instruments being used.

RESPONSE — The smaller the current tolerance selected (above FLA), the more responsive the performance of the control during overload conditions. Conversely, the larger the current tolerance selected (above FLA), the less responsive the control will be to overload conditions. Response sensitivity may be adjusted above or below the recommended, nominal 108% setting by changing the trip current level.

Instruments Required for Calibration

- Digital Voltmeter (DVM), 20 Volts DC scale
- Digital Amp Meter (DAM), Up to 175 amps
- Trim Pot Adjustment Tool (small screwdriver)

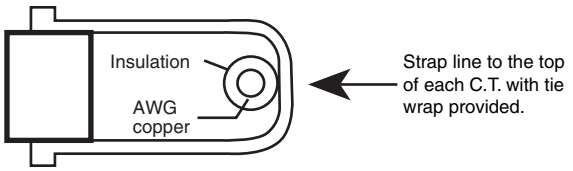
Pre-Installation Checklist

Verify the following before installation:

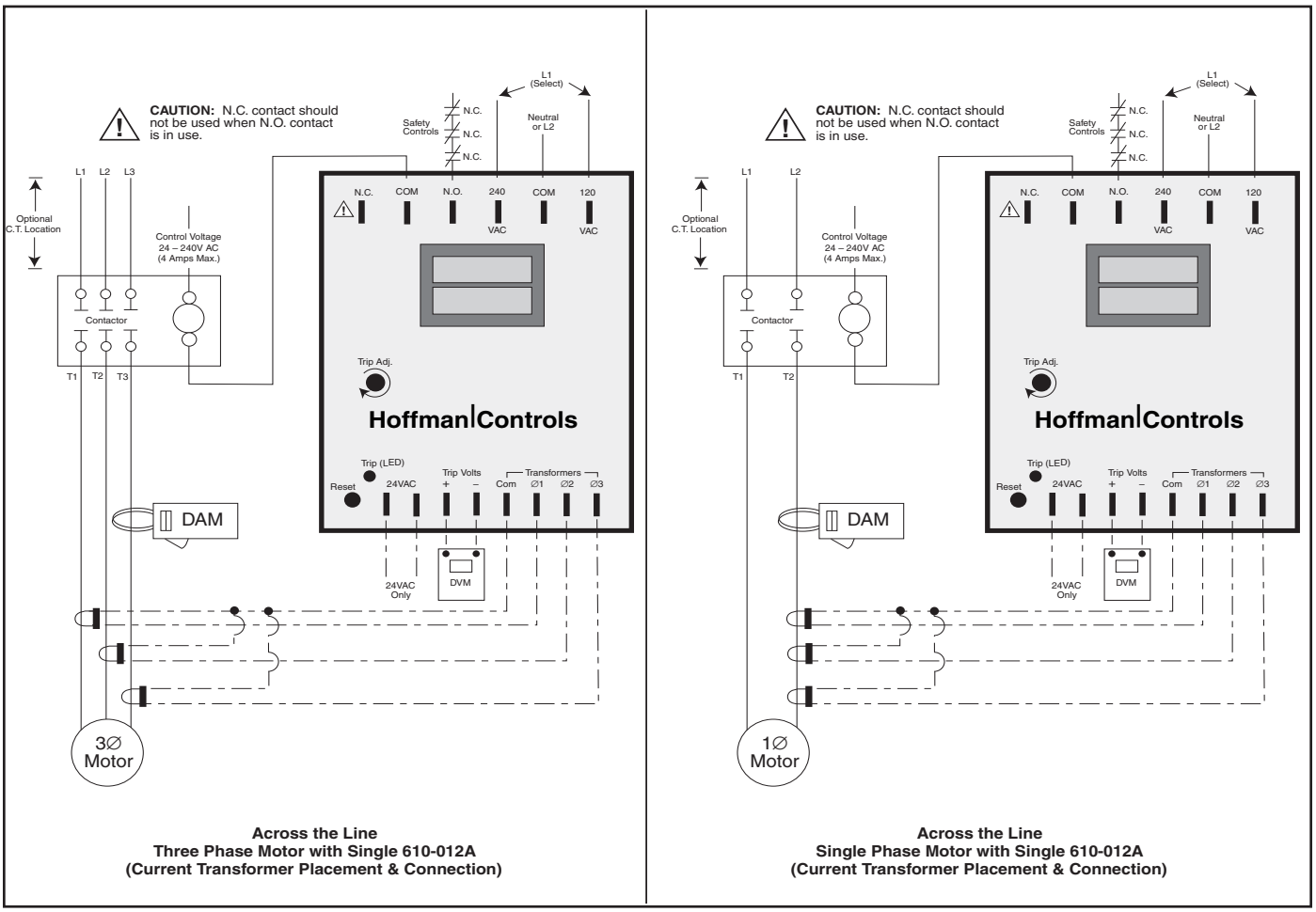
1. The motor (load) is operating normally and functioning without fault.
2. Protection level required is within 20 to 175 amps.
3. The line voltage potential does not exceed 600V AC.
4. The Controller and C.T.s (current transformers) can be located within a drip proof control panel, and meet the operating limits of this specification.
5. One of the following single phase constant voltage sources are available:
   - **a.** 24V AC
   - **b.** 120V AC
   - **c.** 208/240V AC

Installation Instructions

1. Disconnect the power and all control voltage serving the control panel when mounting the 610-012A Controller.
2. Mount the Controller on a non-vibrating, vertical surface and ensure that access is available to the wiring terminals, test points and "Trip Adj." potentiometer.
3. Select the specific wiring diagram and wire the current transformers for one of the following applications (see Figure 2):
   - **a.** Three phase, across the line.
   - **b.** Single phase
   - **c.** Three phase - part winding motors may be protected with the use of two 610-012A units. See App Note 173-0207-001 for wiring details.



Current Transformer C.T. Cross Section
Figure 3



Across the Line
Three Phase Motor with Single 610-012A
(Current Transformer Placement & Connection)

Across the Line
Single Phase Motor with Single 610-012A
(Current Transformer Placement & Connection)

610-012A Wiring Diagrams
Figure 2

CAUTION

To ensure accurate current monitoring the lines should be strapped to the top of C.T. loop with tie wrap provided. Stagger each C.T. to allow maximum separation (minimum interaction).

4. Wire the selected control voltage to the appropriate 1/4" male spade terminals marked:
   - **a.** 24V AC
   - **b.** Common and 120V AC
   - **c.** Common and 208/240V AC
5. Wire the safety control circuit of the contactor/starter through isolated contacts N.O. and COM (4 amps max.).
   NOTE: the N.O. contacts will close when power is applied to the 610-12A.
6. Connect a separate DVM and install a separate DAM as follows: (See Figure 2)
   - **a.** Using DVM connect: Trip Volts (+) and Trip Volts-(–) test posts, set scale to 20V DC.
   - **b.** Install DAM on: Line 1, set scale to anticipated current value.

CAUTION

Do NOT adjust TRIP ADJ. (Amps) potentiometer (15 turn); control is factory set to trip at 20 amps. Complete Fail-Safe Checkout first.

Fail-Safe Checkout

1. Apply line and control voltage to control panel to start motor. Control circuit (N.O./COM) will close.
2. Motor should start, and control trip; stop motor momentarily.
   - **a.** Current observed should exceed 20 amps
   - **b.** Trip Volts observed should exceed 0.25V DC.
3. When current exceeds values above:
   - **a.** Trip will occur. (Trip will vary from 2 seconds to 1 minute (±) depending on the magnitude of current observed above 20 amps.)
   - **b.** Control circuit (N.O./COM) will open,
   - **c.** Load through contactor/starter will disconnect.
4. Installer may re-verify operation as observed in Item 2 above, by resetting red RESET button.
5. Should "trip" fail to occur; check:
   - **a.** All wiring connections. (Items 3, 4, 5)
   - **b.** All voltage/amp reading. (Items 6a, 6b)

Standard Calibration Procedure

This procedure provides an installer with the ability to determine the Trip (protection) Level required for the application. Trip Level is described as a % of FLA as seen by the motor or Trip Volts as seen by the 610-012A.

A range of motor protection from 5% to 15% above FLA is typical. When 8% above FLA is selected (recommended), this value will also provide protection for:

Low Voltage @ –10% (brown-out)

and

High Voltage @ +15% (over-voltage)

1. Disconnect power and control voltage to unit/motor.
2. Obtain the motor nameplate FLA. _____ Amps

   If you have a part winding (6 lead) motor, divide the FLA rating by two (2). See App Note 173-0207-001 for wiring details.
3. Install jumper (shorting clip) across N.O./COM.
4. Connect DVM to:
   - **a.** TRIP VOLTS test post (+)
   - **b.** TRIP VOLTS test post (–)
   - **c.** Select appropriate DC Volts scale.
5. Apply power and control voltage to unit/motor. MOTOR WILL START
6. Locate motor nameplate FLA in Table-1, Page-4, Column-1 and;
   - **a.** Select TRIP VOLTS, DC value in Table 1 (Column-2, 3, or 4) for % overload required. (108% Recommended)
   - **b.** Adjust TRIP ADJ. (Amps) potentiometer (15 turn) CW until TRIP VOLTS, DC value selected is obtained on DVM.
7. Disconnect power and control voltage
8. Remove jumper (shorting clip) from N.O./COM.
9. Apply power and control voltage to unit/motor.
10. Fail-safe through N.O./COM is now under control.
11. Disconnect DVM and DAM. STANDARD CALIBRATION PROCEDURE is complete.

Below 20 Amp FLA Use

The 610-012A Motor Protector may be applied where FLA ratings do not normally exceed 20 amps. Wiring passed through C.T.s may be "looped", effectively providing a FLA multiplier, i.e., 10 amp FLA rated motor leads passed through the C.T.s three (3) times (first pass plus 2 loops) would be treated as approximately 30 amps FLA. Ensure all C.T. loops are formed equally, neatly and in the same direction, perpendicular (at 90°) to the C.T. strap axis. See

Figure-3. Tie wrap or tape loops to ensure shape and proximity are retained. Evaluate and Calibrate looped configuration using Table 1 to ensure adequate protection exists.

Reset — Fail-Safe Trip

When "trip" occurs, a RED LED pilot light will indicate a fail-safe trip and manual lockout of the safety control interlock circuit will occur.

The Controller can be RESET by either a local or remote procedure. (Always install amp meter and observe current level when re-starting after trip.)

Local: Push the red RESET button on the 610-012A control. N.O. contacts will close, and if external N.C. safety control contacts are closed, the motor will restart.

Remote: Disconnect the power source to the control for 5 seconds and reconnect. N.O. contacts will close, and if other N.C. safety control contacts are closed, the motor will restart.

	TRIP VOLTS DC Value				TRIP VOLTS DC Value				TRIP VOLTS DC Value		
AMPS	**@ 108%**	**@ 110%**	**@ 115%**	**AMPS**	**@ 108%**	**@ 110%**	**@ 115%**	**AMPS**	**@ 108%**	**@ 110%**	**@115%**
20	0.248	0.260	0.290	49	1.188	1.217	1.291	80	2.192	2.240	2.360
21	0.280	0.293	0.325	50	1.220	1.250	1.325	82	2.257	2.306	2.429
22	0.313	0.326	0.359	51	1.252	1.283	1.360	84	2.322	2.372	2.498
23	0.345	0.359	0.394	52	1.285	1.316	1.394	86	2.386	2.438	2.567
24	0.378	0.392	0.428	53	1.317	1.349	1.429	88	2.451	2.504	2.636
25	0.410	0.425	0.463	54	1.350	1.382	1.463	90	2.516	2.570	2.705
26	0.442	0.458	0.497	55	1.382	1.415	1.498	92	2.581	2.636	2.774
27	0.475	0.491	0.532	56	1.414	1.448	1.532	94	2.646	2.702	2.843
28	0.507	0.524	0.566	57	1.447	1.481	1.567	96	2.710	2.768	2.912
29	0.540	0.557	0.601	58	1.479	1.514	1.601	98	2.775	2.834	2.981
30	0.572	0.590	0.635	59	1.512	1.547	1.636	100	2.840	2.900	3.050
31	0.604	0.623	0.670	60	1.544	1.580	1.670	104	2.970	3.032	3.188
32	0.637	0.656	0.704	61	1.576	1.613	1.705	108	3.099	3.164	3.326
33	0.669	0.689	0.739	62	1.609	1.646	1.739	112	3.229	3.296	3.464
34	0.702	0.722	0.773	63	1.641	1.679	1.774	116	3.358	3.428	3.602
35	0.734	0.755	0.808	64	1.674	1.712	1.808	120	3.488	3.560	3.740
36	0.766	0.788	0.842	65	1.706	1.745	1.843	124	3.618	3.692	3.878
37	0.799	0.821	0.877	66	1.738	1.778	1.877	128	3.747	3.824	4.016
38	0.831	0.854	0.911	67	1.771	1.811	1.911	132	3.877	3.956	4.154
39	0.864	0.887	0.946	68	1.803	1.844	1.946	136	4.006	4.088	4.292
40	0.896	0.920	0.980	69	1.836	1.877	1.981	140	4.136	4.220	4.430
41	0.928	0.953	1.015	70	1.868	1.910	2.015	144	4.265	4.352	4.568
42	0.961	0.986	1.049	71	1.900	1.943	2.050	148	4.395	4.484	4.706
43	0.993	1.019	1.084	72	1.933	1.976	2.084	152	4.525	4.616	4.844
44	1.026	1.052	1.118	73	1.965	2.009	2.119	156	4.654	4.748	4.982
45	1.058	1.085	1.153	74	1.998	2.042	2.153	160	4.784	4.880	5.120
46	1.090	1.118	1.187	75	2.030	2.075	2.188	164	4.914	5.012	5.258
47	1.123	1.151	1.222	76	2.062	2.108	2.222	168	5.043	5.144	5.396
48	1.155	1.184	1.256	78	2.127	2.174	2.291	172	5.173	5.276	5.534
								175	5.302	5.408	5.672

Amps/Trip Volts @ % Overload
Table 1