

ETC-PTS2 INSTRUCTIONS for ETC-12Q.series

Introduction:

The *ETC-PTS2* is a portable secondary injection test designed to allow qualified individuals to field test *ETC-12Q.series* trip units. The test set may be used to test these trip devices before or after they are installed on the circuit breaker. The breaker must be removed from service before any tests are performed.

Secondary injection is a quick and useful test to verify the operation of the electronic trip unit, the flux trip device, and the basic mechanical operation of the breaker. Secondary injection is NOT capable of checking the following:

- Accuracy and functionality of the current transformers.
- Integrity of the cabling between the current transformers and the trip unit.
- Integrity of the electrical insulation between phases and between phases and ground.
- Contact resistance.
- Functionality of breaker accessories such as close coils, charging motors, shunt trips, UV or OV coils or other similar accessories.
- Speed and mechanical integrity of the operating mechanism or other moving parts of the breaker.

The test set works by injecting a single-phase current that simulates the output of the breaker's current transformers. The magnitude of this current is adjustable, and it can be steered into each of the *ETC-12Q.series* phase inputs.

WARNING!!:

TO PREVENT ELECTRICAL SHOCK OR INJURY, DISCONNECT THE BREAKER FROM ALL PRIMARY AND SECONDARY POWER SOURCES.

ON DRAWOUT EQUIPMENT, VERIFY THAT THE BREAKER IS TRIPPED AND RACK THE BREAKER TO ITS DISCONNECTED POSITION.

DO NOT ATTEMPT TO SECONDARY INJECTION TEST AN ENERGIZED BREAKER

REFER TO NFPA-70E FOR COMPREHENSIVE ELECTRICAL SAFETY GUIDELINES

Connectors and Controls

Figure 1 shows a view of the left side of the PTS2 connectors. Figure 2 is a view of the front panel of the test set. The functions of identified features are detailed in table 1.

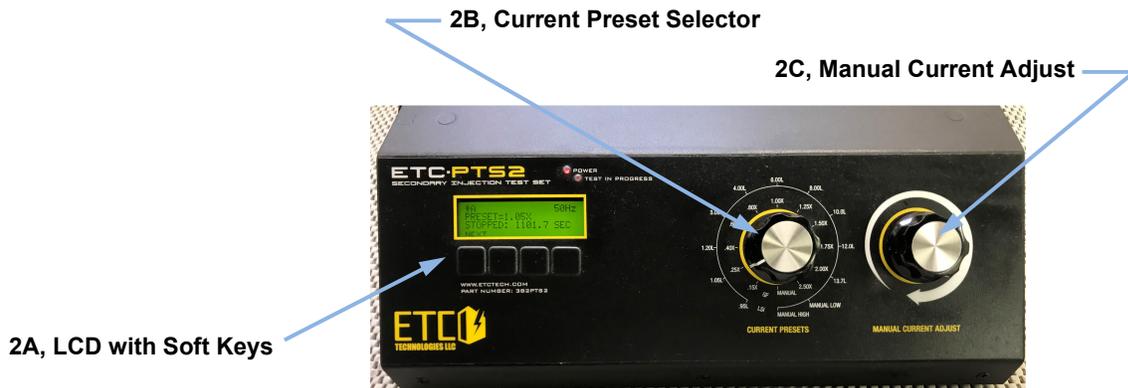
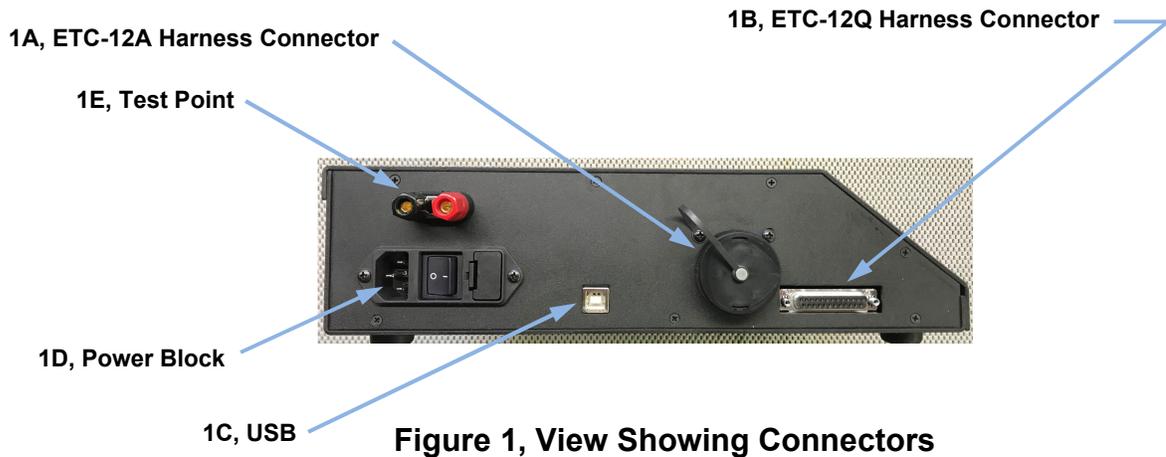


Table 1, CONNECTORS AND CONTROLS		
DESIGNATION	ITEM	FUNCTION / NOTES
1A	ETC-12A Connector	Mating connector for ETC-12A test harness to test legacy ETC-12A.series, ETC-12E.series, ETC-12G.series and ETC-12S.series. Harness is not used with current production and not supplied with test set.
1B	ETC-12Q Connector	Mating connector for ETC-12Q test harness.
1C	USB	USB connector intended for future use.
1D	Power Block	IEC C13 connector for mains power. 100-240V AC 50/60 Hz T1-AL250V fuse
1E	Test Point	Test point for external meter.
2A	LCD	4 line display with 4 soft keys for user input. Function of keys are shown on the display
2B	Current Preset	Selector for preset test currents. The two furthest clockwise positions are low range manual and high range manual. When selector is in one of these positions, test current is adjusted with the manual adjust knob (2C). Different preset test currents are available when the test set is configured for ground fault testing. The furthest clockwise position allows knob (2C) to manually adjust test current.

Setup and Modes of Operation

Before turning on the test set, the user needs to connect the power cable and the test cable. When the PTS2 is first energized, a screen similar to the one shown in figure 3 is displayed. This screen displays the firmware version. Pressing *NEXT* will load the main test screen as shown in figure 4.



FIGURE 3, FIRMWARE VERSION NUMBER

The main test screen allows the user to either:

1. Start a test
2. Change the phase where the test current will be injected
3. Enter the *SETUP* menu
4. Execute pre-programmed tests (not available for the *ETC-12Q.series* at this time)

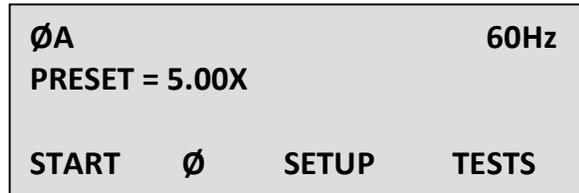


FIGURE 4, MAIN TEST SCREEN

Pressing the *SETUP* button displays the setup screen shown in figure 5. Table 2 details the setup configurations that can be made through this screen.

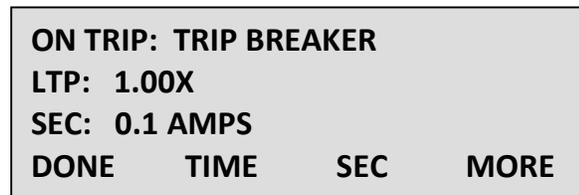


FIGURE 5, SETUP SCREEN

TABLE 2, TEST SET SETUP MENU SELECTIONS AND FUNCTIONS		
SOFTKEY	FUNCTION	FUNCTION / NOTES
DONE	Saves configuration and returns to <i>Main Test Screen</i> .	Configurations survive power down of the PTS2.
TIME	Toggles between <i>TRIP BREAKER</i> and <i>TIMER ONLY</i> . The selection will appear at the top of the screen.	If configured to <i>TRIP BREAKER</i> the <i>ETC-12Q.series</i> under test will fire the breakers <i>MTOP</i> coil and trip the breaker. If <i>TIMER ONLY</i> is selected, when <i>ETC-12Q.series</i> calls for a trip, it will stop the timer on the test set but not actually open the breaker.
SEC	Configures the output current of the <i>PTS2</i> . This setting should match the secondary current on the breaker's current transformer	Allows selection of 0.1, 0.2, and 1.0A at full scale. For the <i>ETC-12Q</i> , the 0.1 setting should be selected.
MORE	Scrolls for additional selections	---
BACK	Scrolls back to previous selections	---
LTP	Allows user to configure long-time pickup rating.	This value should be set to match that of the <i>ETC-12Q.series</i> under test.
FREQ	Configures output frequency.	Selections of 50 and 60 Hz are available.

Because the *PTS2* test set injects a single-phase current, the *ETC-12Q.series* will respond as if a ground fault is present. The ground fault protection band on the *ETC-12Q.series* under test must be temporarily disabled in order to test other protection bands. This can be done either through the setup menu or through *Test Mode*. Refer to the *ETC-12Q.series Section II* manual for more details.

The *PTS2* test set is intended as a field grade test set to confirm the basic functionality of the *ETC-12Q.series*. Ensuring that the *ETC-12Q.series* conforms to the tolerances provided in this document gives reasonable assurance that it is functioning properly. Precise results can be obtained through primary injection testing using a load bank with a primary voltage not less than 100V.

Long-Time Pickup Test:

The purpose of the long-time pickup test is to confirm that the *ETC-12Q.series* is properly metering current and that it picks up and begins timing to trip on the long-time band at the proper current. The test is performed as detailed in table 3.

TABLE 3, LONG TIME PICKUP TEST		
STEP	ACTION	EXPECTED RESULT
1	Set <i>Current Preset</i> control to <i>Manual Low</i>	---
2	Select $\emptyset A$ on <i>Main Test Screen</i> . Rotate <i>MANUAL CURRENT ADJUST</i> to minimum position.	---
3	Select <i>START</i> on <i>Main Test Screen</i>	Timer begins to run
4	Slowly increase current using <i>MANUAL CURRENT ADJUST</i> . Observe <i>ETC-12Q.series</i> under test and note when the red pick-up LED illuminates.	Test set should display a current between 0.90L and 1.13L
5	Press <i>STOP</i> then repeat steps 1-4 for $\emptyset B$ and $\emptyset C$	---

Long-Time Delay Test:

The long-time delay test confirms that the device being tested will properly time and trip when it is long-time pickup. This test is usually performed with a current that is 3 times the long-time pickup setting (3.00L). Table 5 provides tolerances for various test currents but it is not necessary to perform this test at more than one test point. Table 4 depicts the methodology of this test.

TABLE 4, LONG TIME DELAY TEST		
STEP	ACTION	EXPECTED RESULT
1	Preset test current. If the test is to be performed at 1.20 or 3.00L, current is preset using the <i>CURRENT PRESET</i> control set to the appropriate value. If the test is to be performed at 1.50L, the current preset is manually set in the <i>MANUAL LOW</i> range.	---
2	Select $\emptyset A$ and press <i>START</i>	Timer begins to run, unit under test indicates that it is in pickup.
3	Allow test to continue until timer stops or breaker trips, depending on configuration.	Verify that test set displays a time within the limits shown in table 5.
4	Press <i>CLEAR</i> then repeat steps 1-3 for $\emptyset B$ and $\emptyset C$	---

TABLE 5, LONG TIME DELAY TOLERANCES						
LTD (sec @ 1.5L)	I = 1.20L		I = 1.50L		I = 3X LTP	
	MIN	MAX	MIN	MAX	MIN	MAX
16	21.25	29.25	13.60	18.72	3.40	4.68
24	31.88	43.88	20.40	28.08	5.10	7.02
32	42.50	58.50	27.20	37.44	6.80	9.36
40	53.13	73.13	34.00	46.80	8.50	11.70
48	63.75	87.75	40.80	56.16	10.20	14.04
56	74.38	102.38	47.60	65.52	11.90	16.38
64	85.00	117.00	54.40	74.88	13.60	18.72
72	95.63	131.63	61.20	84.24	15.30	21.06
80	106.25	146.25	68.00	93.60	17.00	23.40
96	127.50	175.50	81.60	112.32	20.40	28.08
112	148.75	204.75	95.20	131.04	23.80	32.76
128	170.00	234.00	108.80	149.76	27.20	37.44
144	191.25	263.25	122.40	168.48	30.60	42.12
160	212.50	292.50	136.00	187.20	34.00	46.80
176	233.75	321.75	149.60	205.92	37.40	51.48
192	255.00	351.00	163.20	224.64	40.80	56.16
208	276.25	380.25	176.80	243.36	44.20	60.84
224	297.50	409.50	190.40	262.08	47.60	65.52
240	318.75	438.75	204.00	280.80	51.00	70.20
256	340.00	468.00	217.60	299.52	54.40	74.88
272	361.25	497.25	231.20	318.24	57.80	79.56
288	382.50	526.50	244.80	336.96	61.20	84.24
304	403.75	555.75	258.40	355.68	64.60	88.92
320	425.00	585.00	272.00	374.40	68.00	93.60
336	446.25	614.25	285.60	393.12	71.40	98.28
352	467.50	643.50	299.20	411.84	74.80	102.96
368	488.75	672.75	312.80	430.56	78.20	107.64
384	510.00	702.00	326.40	449.28	81.60	112.32
400	531.25	731.25	340.00	468.00	85.00	117.00
416	552.50	760.50	353.60	486.72	88.40	121.68
432	573.75	789.75	367.20	505.44	91.80	126.36
448	595.00	819.00	380.80	524.16	95.20	131.04
464	616.25	848.25	394.40	542.88	98.60	135.72
480	637.50	877.50	408.00	561.60	102.00	140.40

Short-Time and Instantaneous Pickup Tests:

The Short-Time and Instantaneous pickup tests confirm that the *ETC-12Q.series* properly senses higher current levels enters pickup for its short-circuit protection bands.

It is likely that other protection bands may interfere with these pickup tests. These can be overcome by temporarily changing settings or using *TEST MODE* to disable the interfering bands.

Table 6 details the procedure for performing short time and instantaneous pickup tests. Tolerances are listed in table 7.

TABLE 6, SHORT TIME AND INSTANTANEOUS PICKUP TESTS			
STEP	ACTION	EXPECTED RESULT	NOTES
1	Set <i>CURRENT PRESET</i> to the proper manual range. Use <i>LOW</i> if the pickup point is below 5.0L and <i>HIGH</i> for other settings.	---	If breaker trips prematurely on the instantaneous band, the Closing Current Release may be operating. This feature can be overridden by closing the breaker or temporarily shorting the DINF/MOC contacts on the bottom of the <i>ETC-12Q.series</i> .
2	Select $\emptyset A$ and press <i>START</i> . Slowly increase the test current until the <i>ETC-12Q.series</i> trips. Be careful not to exceed this value	Confirm that the current at the time of the trip conforms to the values listed in table 7.	
3	Press <i>CLEAR</i> then repeat steps 1 - 2 for $\emptyset B$ and $\emptyset C$	---	

TABLE 7, INSTANTANEOUS AND SHORT TIME PICKUP TOLERANCES		
SETTING	LOWER TOLERANCE LIMIT	UPPER TOLERANCE LIMIT
1.5L	1.28L	1.73L
2.0L	1.70L	2.30L
2.5L	2.13L	2.88L
3.0L	2.55L	3.45L
3.5L	2.98L	4.03L
4.0L	3.40L	4.60L
4.5L	3.83L	5.18L
5.0L	4.50L	5.50L
6.0L	5.40L	6.60L
7.0L	6.30L	7.70L
8.0L	7.20L	8.80L
9.0L	8.10L	9.90L
10.0L	9.00L	11.00L
11.0L	9.90L	12.10L
12.0L	10.80L	13.20L

Short-Time Delay Test:

The short time delay test confirms that the device being tested properly times out and trips when it is operating in the short time protection band.

Test methodology for the short time delay test is outlined in table 8. Test tolerances are in tables 9 and 10.

STEP	ACTION	EXPECTED RESULT	NOTES
1	Select a test current that is at least 25% above the pickup value. Preset this current.	---	If breaker trips prematurely on the instantaneous band, the Closing Current Release may be operating. This feature can be overridden by closing the breaker or temporarily shorting the DINF/MOC contacts on the bottom of the ETC-12Q.series.
2	Select ØA and press <i>START</i> .	The breaker will trip on the short time band. Confirm that the time conforms to table 9 for constant delays or table 10 if the ETC-12Q.series is configured with I ² t delay.	
3	Press <i>CLEAR</i> then repeat steps 1 - 2 for ØB and ØC	---	

STD SETTING (s)	LOWER TOLERANCE (s)	UPPER TOLERANCE (s)
.070	.055	.125
.100	.068	.142
.150	.120	.192
.200	.160	.256
.300	.240	.384
.400	.320	.480
.500	.400	.600

ST DELAY	I = 3L		I = 4L		I = 5L		I = 6L		I = 7L		I = 8L		I = 9L	
	MIN	MAX												
.070s	0.611	1.556	0.344	0.875	0.220	0.560	0.153	0.389	0.112	0.286	0.086	0.219	0.068	0.173
.100s	0.833	2.000	0.469	1.125	0.300	0.720	0.208	0.500	0.153	0.367	0.117	0.281	0.093	0.222
.150s	1.222	2.556	0.688	1.438	0.440	0.920	0.306	0.639	0.224	0.469	0.172	0.359	0.136	0.284
.200s	1.889	3.111	1.063	1.750	0.680	1.120	0.472	0.778	0.347	0.571	0.266	0.438	0.210	0.346
.300s	2.778	4.444	1.563	2.500	1.000	1.600	0.694	1.111	0.510	0.816	0.391	0.625	0.309	0.494
.400s	3.889	6.111	2.188	3.438	1.400	2.200	0.972	1.528	0.714	1.122	0.547	0.859	0.432	0.679
.500s	5.111	7.556	2.875	4.250	1.840	2.720	1.278	1.889	0.939	1.388	0.719	1.063	0.568	0.840

TIME TO TRIP (SECONDS)

Instantaneous Delay Test:

The instantaneous delay test confirms that the *ETC-12Q.series* trips with no intentional delay when subject to a current above its programmed instantaneous pickup point.

Test methodology for the instantaneous delay test is outlined in table 11.

TABLE 11, INSTANTANEOUS DELAY			
STEP	ACTION	EXPECTED RESULT	NOTES
1	Select a test current that is at least 25% above the pickup value. Preset this current.	---	If breaker trips prematurely on the instantaneous band, the Closing Current Release may be operating. This feature can be overridden by closing the breaker or temporarily shorting the DINF/MOC contacts on the bottom of the <i>ETC-12Q.series</i> .
2	Select ØA and press <i>START</i> .	The breaker will trip on the instantaneous band. Confirm that trip time is less than .050 SEC	
3	Press <i>CLEAR</i> then repeat steps 1 - 2 for ØB and ØC	---	

Closing Current Release Test:

The closing current release overrides the programmed short-circuit protection in the special circumstance where the breaker is being closed onto a fault. Under these conditions, the *ETC-12Q.series* will trip on the instantaneous band regardless of how it is configured.

This feature can be tested as detailed in table 12. Note that if bench testing the *ETC-12Q.series*, closing the breaker can be simulated by shorting the terminals on the bottom or the unit that are labeled either *DINF* or *MOC*.

TABLE 12, CLOSING CURRENT RELEASE TEST			
STEP	ACTION	EXPECTED RESULT	NOTES
1	Preset test current of 8.5F for breaker frames below 4000A and 4.7F for all other frames.	---	Thresholds are based on the breaker frame rating (F), not the long-time pickup rating. If the breaker is applied below its maximum rating, be sure to apply the appropriate test current.
2	Open breaker.		
3	Select $\emptyset A$ and press <i>START</i> .	Breaker trips as configured.	
3	Press <i>CLEAR</i> then preset test current of 11.5F for breaker frames below 4000A and 6.5F for all other frames.	---	
4	Press <i>START</i>	Breaker trips on instantaneous.	
5	Close breaker and repeat step 4.	Breaker trips as configured.	

Ground Fault Pickup Test:

The ground fault pickup test confirms that the *ETC-12Q.series* picks up and begins timing to trip when it senses a ground fault current above its set point.

The methodology for the ground fault pickup test is described in table 13. Pickup tolerances are listed in table 14.

TABLE 13, GROUND FAULT PICKUP TEST		
STEP	ACTION	EXPECTED RESULT
1	Set <i>CURRENT PRESET</i> control to <i>MANUAL</i> (full clockwise for GF).	---
2	Select $\emptyset GF$ on <i>Main Test Screen</i> . Rotate <i>MANUAL CURRENT ADJUST</i> to minimum position.	---
3	Select <i>START</i> on <i>Main Test Screen</i>	Timer begins to run
4	Slowly increase current using <i>MANUAL CURRENT ADJUST</i> until breaker trips	Observe current at trip. Confirm that it meets the requirements of table 14.

TABLE 14, GROUND FAULT PICKUP TOLERANCES		
SETTING	LOWER TOLERANCE LIMIT	UPPER TOLERANCE LIMIT
.20X	.16X	.24X
.25X	.20X	.30X
.30X	.24X	.36X
.35X	.28X	.42X
.40X	.32X	.48X
.45X	.36X	.54X
.50X	.40X	.60X
.55X	.44X	.66X
.60X	.48X	.72X
.65X	.52X	.78X
.70X	.56X	.84X
.75X	.60X	.90X
.80X	.64X	.96X
.85X	.68X	1.02X
.90X	.72X	1.08X
.95X	.76X	1.14X
1.00X	.80X	1.20X
1.10X	.88X	1.32X
1.20X	.96X	1.44X
1.30X	1.04X	1.56X
1.40X	1.12X	1.68X
1.50X	1.20X	1.80X
1.60X	1.28X	1.92X
1.70X	1.36X	2.04X
1.80X	1.44X	2.16X
1.90X	1.52X	2.28X
2.00X	1.60X	2.40X

Ground Fault Delay Test:

The ground fault delay test confirms that the *ETC-12Q.series* executes the proper delay before tripping the breaker once ground fault current exceeds its setting. Test methodology is described in table 15 and tolerance limits for constant delays are shown in table 16 while tolerance limits delays employing an I²t ramp are shown in table 17.

TABLE 15, GROUND FAULT DELAY TEST		
STEP	ACTION	EXPECTED RESULT
1	Configure test set to ØGF	---
2	Select a test point that is at least 2x the GF pickup setting. Preset test point using either the CURRENT PRESET or MANUAL CURRENT ADJUST controls.	---
3	Press <i>START</i>	Breaker trips. Confirm time meets requirements of table 16 or 17, as appropriate.

TABLE 16, GROUND FAULT DELAY TOLERANCES (CONSTANT)		
DELAY SETTING (s)	LOWER TOLERANCE (s)	UPPER TOLERANCE (s)
.100	.065	.135
.150	.105	.195
.200	.150	.250
.300	.240	.360
.400	.320	.480
.500	.400	.600

TABLE 17, GROUND FAULT DELAY TOLERANCES (I ² t)																
GF DELAY	I = .15x		I = .25x		I = .50X		I = .75x		I = 1.0x		I = 1.25x		I = 1.50x		I = 1.75x	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
.100s	9.78	28.44	3.52	10.24	.880	2.56	.391	1.138	.220	.640	.141	.410	.098	.284	.072	.209
.150s	16.00	39.11	5.76	14.08	1.44	3.52	.640	1.568	.360	.882	.230	.563	.160	.392	.118	.287
.200s	24.89	48.00	8.96	17.28	2.40	4.32	.996	1.920	.560	1.080	.358	.691	.249	.480	.183	.353
.300s	37.33	69.33	13.44	24.96	3.36	6.24	1.493	2.773	.840	1.560	.538	.998	.373	.693	.274	.509
.400s	49.78	88.89	17.92	32.00	4.48	8.00	1.991	3.556	1.120	2.000	.717	1.280	.498	.889	.366	.653
.500s	62.22	112.00	22.40	40.32	5.60	10.08	2.489	4.480	1.400	2.520	.896	1.613	.622	1.120	.457	.823
TIME TO TRIP (SECONDS)																