

Annunciator Target Relay

Theory of Operation

Basic Functions of the ATR

In normal operation, the ATR receives an external signal, a Trip input, which causes the ATR to enter the TRIP state. A front panel LED is lit and two internal auxiliary outputs close. The ATR is reset by depressing a manual reset pushbutton on the front of the device.

There are two versions of the ATR currently available.

Model 686-100A has a 5 millisecond response time and latches when the Trip signal reaches that duration. Both the LED and the two isolated auxiliary outputs remain latched until the reset switch is pushed. In this model, the Trip input is also isolated from the power input.

Model 686-110A differs in three respects.

1. The auxiliary outputs are turned on when a Trip input is received, but they are not latched. When the Trip input ceases to be present (usually indicating that a fault has been cleared) the auxiliary outputs open. The LED remains latched until Reset is pushed.
2. The 686-110A is designed to facilitate the use of both a normally open and normally closed input switch. This type of operation (as shown in Figure 1b) is most often used in sudden pressure relay applications.
3. The standard response time for the model 686-110A is 15 milliseconds to conform to the needs of sudden pressure relaying.

Response time is defined as the length of input signal pulse required to move the ATR into the Trip state. Upon special request, at time of order, response time for either model can be factory set in a range from 1 millisecond to 1.875 seconds or 1 millisecond to 15 seconds with reduced resolution.

If the ATR is in the Trip state and power is interrupted, then it will return to the Trip state when power is restored.

Physical Dimensions, Panel Mounting and Electrical Connections

All of the connections to the ATR are on the rear. The LED and reset button are on the front panel. Physical dimensions, mounting information and connection labeling are shown in the attached drawings at the end of this document.

Trip Input

In the 686-100A, the Trip input stage is optically isolated from the rest of the circuit. In the 686-110A a resistor between the negative Trip input and the negative power input allows a dual change of state (normally open and normally closed input switches) to be used to signal a Trip.

The user input switches for the two units are shown in Figure 1.

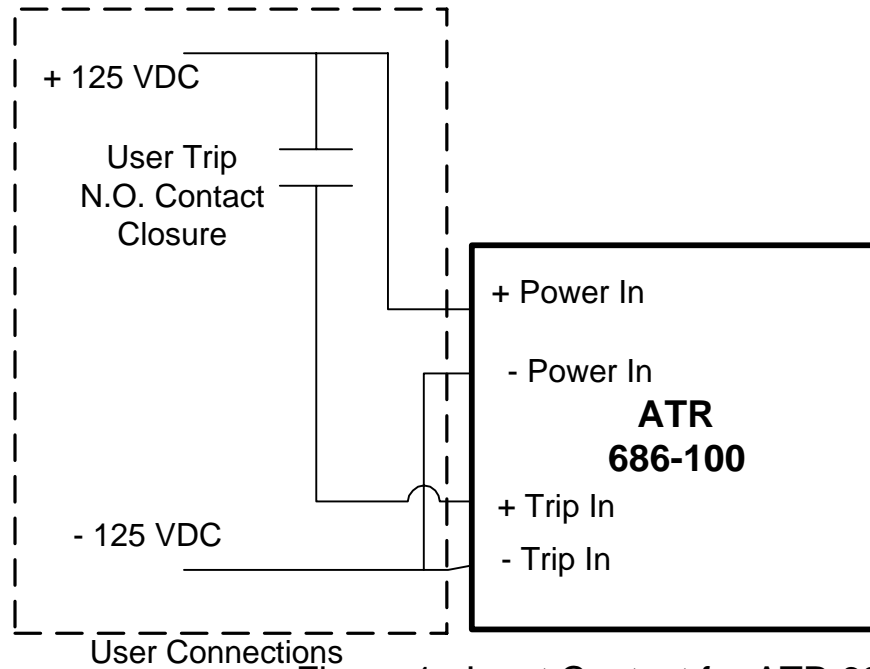


Figure 1a Input Contact for ATR 686-100

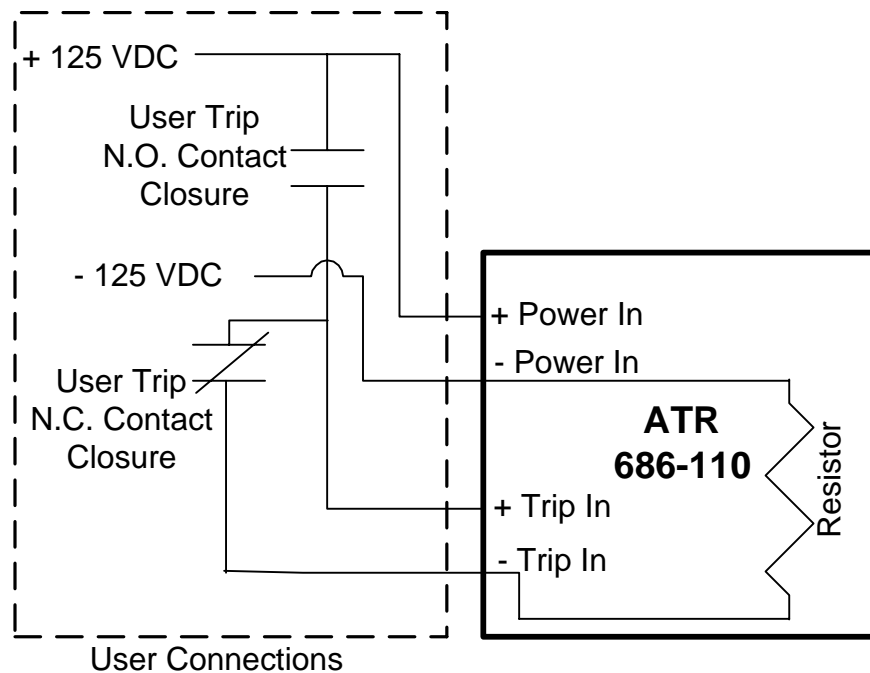


Figure 1b Input Contact for ATR 686-110

The input circuitry will respond to a voltage above the threshold voltage. The maximum threshold voltage is 22 V DC. Current burden is less than 3 mA at 125 VDC input.

A transient voltage suppressor (TVS) also protects the Trip input, which has approximately 1 millisecond of analog filtering to reduce sensitivity to noise.

After the Trip input has been active for approximately 1 millisecond a signal that Trip input is present is delivered to the microprocessor.

The microprocessor then validates the Trip signal using a fuzzy logic filtering loop. The fuzzy logic filter applies essentially the same sort of reasoning that a human would to determine if a real Trip input is present. It checks the input at a regular interval (of approximately 50 microseconds). If the input is constantly present for the prescribed response time setting, then the ATR trips. If there are gaps in the Trip input, then the microprocessor takes enough extra data to make certain that a valid Trip is present. For example, if the Trip signal is on for 90% of the time with interspersed 10% gaps, then the ATR will wait an additional 20% before entering the Trip state.

If the Trip input is present for a time less than the set response time and then interrupted, the ATR will wait for a time equal to the time that the Trip was present, plus approximately 10 milliseconds, and then will reset to the normal state.

There is the usual trade-off between response time and noise. At any response time greater than ~ 4 milliseconds the ATR is insensitive to most normal noise sources. In some systems there may be more severe noise, or system reasons to further delay the response.

The response time is set by the on-board DIP switch. Settings are covered in the Configuration section of this bulletin.

Configuration

The response time, seal-in and LED blinking are set by the on-board DIP switch. Switches 1 through 6 control timing. Table 1 shows how to set specific response times for the 686-110A and table 2 shows how to set specific response times for the 686-T15 Switches 7 and 8 control seal-in and LED blink respectively. This is described in detail later in this section.

Figure 2 shows the position and orientation of the DIP switch. Removing the four small screws from the back of the ATR and removing the front cover assembly accesses the DIP switch.

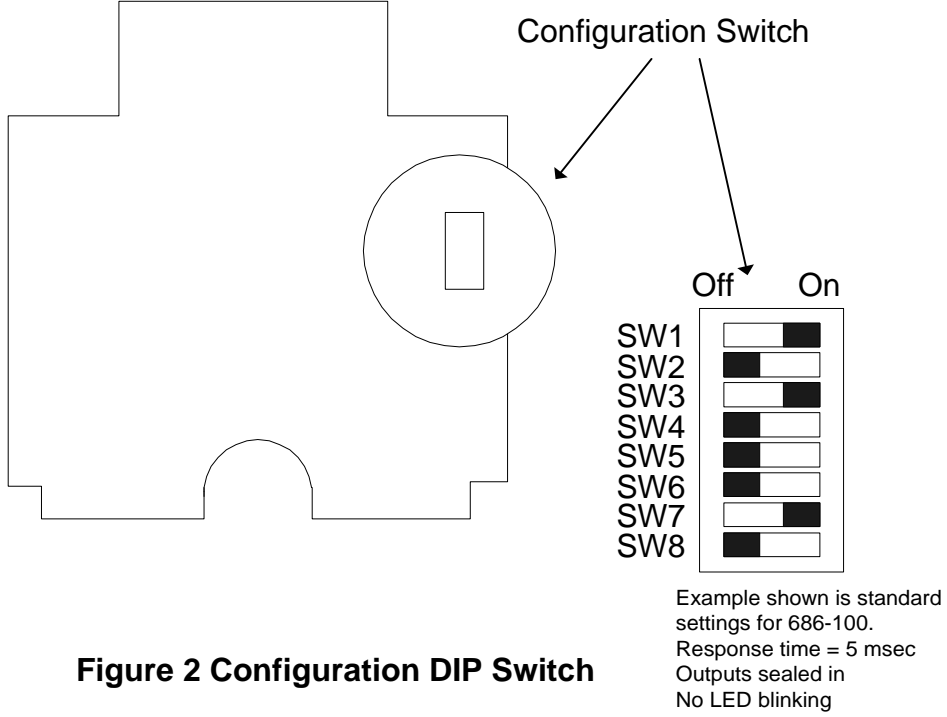


Figure 2 Configuration DIP Switch

Switch 6	Switch 5	Switch 4	Switch 3	Switch 2	Switch 1	Response Time (milliseconds)
Off	Off	Off	Off	Off	Off	(1)
Off	Off	Off	Off	Off	On	1
Off	Off	Off	Off	On	Off	2
Off	Off	Off	Off	On	On	3
Off	Off	Off	On	Off	Off	4
Off	Off	Off	On	Off	On	5 (686-100A standard)
Off	Off	Off	On	On	Off	6
Off	Off	Off	On	On	On	7
Off	Off	On	Off	Off	Off	8
Off	Off	On	Off	Off	On	9
Off	Off	On	Off	On	Off	10
Off	Off	On	Off	On	On	11
Off	Off	On	On	Off	Off	12
Off	Off	On	On	Off	On	13
Off	Off	On	On	On	Off	14
Off	Off	On	On	On	On	15 (686-110A standard)
Off	On	Off	Off	Off	Off	(1)
Off	On	Off	Off	Off	On	5
Off	On	Off	Off	On	Off	10
Off	On	Off	Off	On	On	15
Off	On	Off	On	Off	Off	20
Off	On	Off	On	Off	On	25
Off	On	Off	On	On	Off	30
Off	On	Off	On	On	On	35
Off	On	On	Off	Off	Off	40
Off	On	On	Off	Off	On	45
Off	On	On	Off	On	Off	50
Off	On	On	Off	On	On	55
Off	On	On	On	Off	Off	60
Off	On	On	On	Off	On	65
Off	On	On	On	On	Off	70
Off	On	On	On	On	On	75
On	Off	Off	Off	Off	Off	(1)
On	Off	Off	Off	Off	On	25
On	Off	Off	Off	On	Off	50
On	Off	Off	Off	On	On	75
On	Off	Off	On	Off	Off	100
On	Off	Off	On	Off	On	125
On	Off	Off	On	On	Off	150
On	Off	Off	On	On	On	175
On	Off	On	Off	Off	Off	200
On	Off	On	Off	Off	On	225
On	Off	On	Off	On	Off	250
On	Off	On	Off	On	On	275
On	Off	On	On	Off	Off	300
On	Off	On	On	Off	On	325
On	Off	On	On	On	Off	350
On	Off	On	On	On	On	275
On	On	Off	Off	Off	Off	(1)
On	On	Off	Off	Off	On	125
On	On	Off	Off	On	On	250
On	On	Off	Off	On	On	375
On	On	Off	On	Off	Off	500
On	On	Off	On	Off	On	625
On	On	Off	On	On	Off	750
On	On	Off	On	On	On	875
On	On	On	Off	Off	Off	1000
On	On	On	Off	Off	On	1125
On	On	On	Off	On	Off	1250
On	On	On	Off	On	On	1375
On	On	On	On	Off	Off	1500
On	On	On	On	Off	On	1625
On	On	On	On	On	Off	1750
On	On	On	On	On	On	1875

Table 1

Switch Settings for Specific Response Times for 686-100A and 686-110A

Switch 6	Switch 5	Switch 4	Switch 3	Switch 2	Switch 1	Response Time (milliseconds)
Off	Off	Off	Off	Off	Off	(1)
Off	Off	Off	Off	Off	On	1
Off	Off	Off	Off	On	Off	2
Off	Off	Off	Off	On	On	3
Off	Off	Off	On	Off	Off	4
Off	Off	Off	On	Off	On	5
Off	Off	Off	On	On	Off	6
Off	Off	Off	On	On	On	7
Off	Off	On	Off	Off	Off	8
Off	Off	On	Off	Off	On	9
Off	Off	On	Off	On	Off	10
Off	Off	On	Off	On	On	11
Off	Off	On	On	Off	Off	12
Off	Off	On	On	Off	On	13
Off	Off	On	On	On	Off	14
Off	Off	On	On	On	On	15
Off	On	Off	Off	Off	Off	(1)
Off	On	Off	Off	Off	On	10
Off	On	Off	Off	On	Off	20
Off	On	Off	Off	On	On	30
Off	On	Off	On	Off	Off	40
Off	On	Off	On	Off	On	50
Off	On	Off	On	On	Off	60
Off	On	Off	On	On	On	70
Off	On	On	Off	Off	Off	80
Off	On	On	Off	Off	On	90
Off	On	On	Off	On	Off	100
Off	On	On	Off	On	On	110
Off	On	On	On	Off	Off	120
Off	On	On	On	Off	On	130
Off	On	On	On	On	Off	140
Off	On	On	On	On	On	150
On	Off	Off	Off	Off	Off	(1)
On	Off	Off	Off	Off	On	100
On	Off	Off	Off	On	Off	200
On	Off	Off	Off	On	On	300
On	Off	Off	On	Off	Off	400
On	Off	Off	On	Off	On	500
On	Off	Off	On	On	Off	600
On	Off	Off	On	On	On	700
On	Off	On	Off	Off	Off	800
On	Off	On	Off	Off	On	900
On	Off	On	Off	On	Off	1000
On	Off	On	Off	On	On	1100
On	Off	On	On	Off	Off	1200
On	Off	On	On	Off	On	1300
On	Off	On	On	On	Off	1400
On	Off	On	On	On	On	1500
On	On	Off	Off	Off	Off	(1)
On	On	Off	Off	Off	On	1000
On	On	Off	Off	On	Off	2000
On	On	Off	Off	On	On	3000
On	On	Off	On	Off	Off	4000
On	On	Off	On	Off	On	5000 (686-T15 standard)
On	On	Off	On	On	Off	6000
On	On	Off	On	On	On	7000
On	On	On	Off	Off	Off	8000
On	On	On	Off	Off	On	9000
On	On	On	Off	On	Off	10000
On	On	On	Off	On	On	11000
On	On	On	On	Off	Off	12000
On	On	On	On	Off	On	13000
On	On	On	On	On	Off	14000
On	On	On	On	On	On	15000

Table 2
Switch Settings for Specific Response Times for 686-T15

Switch 6	Switch 5	Switch 4	Switch 3	Switch 2	Switch 1	Response Time (seconds)
Off	Off	Off	Off	Off	Off	(0.001) Do not use.
Off	Off	Off	Off	Off	On	0.005
Off	Off	Off	Off	On	Off	0.010
Off	Off	Off	Off	On	On	0.015
Off	Off	Off	On	Off	Off	0.020
Off	Off	Off	On	Off	On	0.025
Off	Off	Off	On	On	Off	0.030
Off	Off	Off	On	On	On	0.035
Off	Off	On	Off	Off	Off	0.040
Off	Off	On	Off	Off	On	0.045
Off	Off	On	Off	On	Off	0.050
Off	Off	On	Off	On	On	0.055
Off	Off	On	On	Off	Off	0.060
Off	Off	On	On	Off	On	0.065
Off	Off	On	On	On	Off	0.070
Off	Off	On	On	On	On	0.075
Off	On	Off	Off	Off	Off	(0.001) Do not use.
Off	On	Off	Off	Off	On	0.10
Off	On	Off	Off	On	Off	0.20
Off	On	Off	Off	On	On	0.30
Off	On	Off	On	Off	Off	0.40
Off	On	Off	On	Off	On	0.50
Off	On	Off	On	On	Off	0.60
Off	On	Off	On	On	On	0.70
Off	On	On	On	Off	Off	0.80
Off	On	On	On	Off	On	0.90
Off	On	On	On	Off	On	1.00
Off	On	On	On	On	On	1.10
Off	On	On	On	Off	Off	1.20
Off	On	On	On	On	On	1.30
Off	On	On	On	On	Off	1.40
Off	On	On	On	On	On	1.50
On	Off	Off	Off	Off	Off	(0.001) Do not use.
On	Off	Off	Off	Off	On	2.0
On	Off	Off	Off	On	Off	4.0
On	Off	Off	Off	On	On	6.0
On	Off	Off	On	Off	Off	8.0
On	Off	Off	On	Off	On	10.0
On	Off	Off	On	On	Off	12.0
On	Off	Off	On	On	On	14.0
On	Off	On	Off	Off	Off	16.0
On	Off	On	Off	Off	On	18.0
On	Off	On	Off	On	Off	20.0
On	Off	On	Off	On	On	22.0
On	Off	On	On	Off	Off	24.0
On	Off	On	On	Off	On	26.0
On	Off	On	On	On	Off	28.0
On	Off	On	On	On	On	30.0
On	On	Off	Off	Off	Off	686-T60-001 (0.001) Do not use.
On	On	Off	Off	Off	On	4
On	On	Off	Off	On	Off	8
On	On	Off	Off	On	On	12
On	On	Off	On	Off	Off	16
On	On	Off	On	Off	On	20
On	On	Off	On	On	Off	24
On	On	Off	On	On	On	28
On	On	On	Off	Off	Off	32
On	On	On	Off	Off	On	36
On	On	On	Off	On	Off	40
On	On	On	Off	On	On	44
On	On	On	On	Off	Off	48
On	On	On	On	Off	On	52
On	On	On	On	On	Off	70
On	On	On	On	On	On	60 686-T60

Table 3
Switch Settings for Specific Response Times for 686-T60

Switch 7

Off = Contacts not sealed in.

On = Contacts sealed in.

If switch 7 is on then the auxiliary contacts close when the ATR trips, and remain closed until the reset button on the front panel is pressed.

If switch 7 is off then the auxiliary contacts close when the ATR trips, but only stay closed as long as a Trip input to the ATR is present.

Switch 8

Off = Normal LED operation. LED is set by a Trip and cleared by the front panel reset switch.

On = LED will blink when: switch 7 is off, the ATR has been tripped, and the TRIP input is no longer present. Otherwise operation is identical to normal LED operation.

If switch 8 is on then the LED will be off when the ATR has not been tripped, on steadily when the while the output contacts are closed, and will blink when the ATR has been tripped but the auxiliary contacts are no longer closed. The blinking can only occur when the auxiliary contacts are not sealed in. It allows the operator to identify the source of a trip, while knowing that the fault that caused it has cleared.

If switch 8 is off the LED is off if no trip has occurred, and on steadily if a trip has occurred.

This paragraph describes how the response time is computed from the switch settings. For most purposes it is easier to use Table 1, Table 2 and Table 3, but the following information is included for reference. There are two factors in the response time, the base time and a multiplier. The base time is equal to the binary code of switches 1 through 4, with switch 1 being the least significant bit. This time is then multiplied by the multiplier, which is determined by switches 5 and 6. If switches 5 and 6 are both off, then the multiplier is 1. If switch 5 is on and switch 6 is off, the multiplier is 5. If switch 6 is on and switch 5 is off the multiplier is 25. If both switch 5 and switch 6 are on the multiplier is 125.

For the 686-T15 unit if switches 5 and 6 are both off, then the multiplier is also 1. If switch 5 is on and switch 6 is off, the multiplier is 10. If switch 6 is on and switch 5 is off the multiplier is 100. If both switch 5 and switch 6 are on the multiplier is 1000.

If switches 1,2,3, and 4 are all off then multiplicand is zero and the delay is 1 ms.

For the 686-T60 unit if switches 5 and 6 are both off, then the multiplier is also 5. If switch 5 is on and switch 6 is off, the multiplier is 100. If switch 6 is on and switch 5 is off the multiplier is 2000. If both switch 5 and switch 6 are on the multiplier is 4000.

If switches 1,2,3, and 4 are all off then multiplicand is zero and the delay is 1 msec. This setting is not normally used.

Auxiliary Outputs

The ATR includes two solid-state, normally open auxiliary outputs that close simultaneously to signal that a Trip has occurred. These outputs are rated as shown on the attached drawings.

In the standard configuration of the 686-110A the auxiliary outputs do not seal in and will re-open when the Trip input signal is removed.

In the standard configuration of the 686-100A the auxiliary outputs seal in and will only re-open when the Reset button on the front of the device is pushed.

In both models seal-in operation is controlled by the configuration DIP switch as outlined in the configuration section.