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# Appendix

# Appendix A - Timer Functions

## Selecting a Timer's Function

Selecting one of the five most common timing functions can be as easy as answering three questions on the chart below. If you have trouble answering these questions, try drawing a connection diagram that shows how the timer and load are connected. Time diagrams and written descriptions of the five most popular functions, plus other common functions. Instantaneous contacts, accumulation, pause timing functions, and flashing LED's are included in some units to expand the versatility of the timer. These expanded operations are explained on the product's catalog page. Time diagrams are used on these pages along with text and international symbols for functions.

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## Function Selection Guide

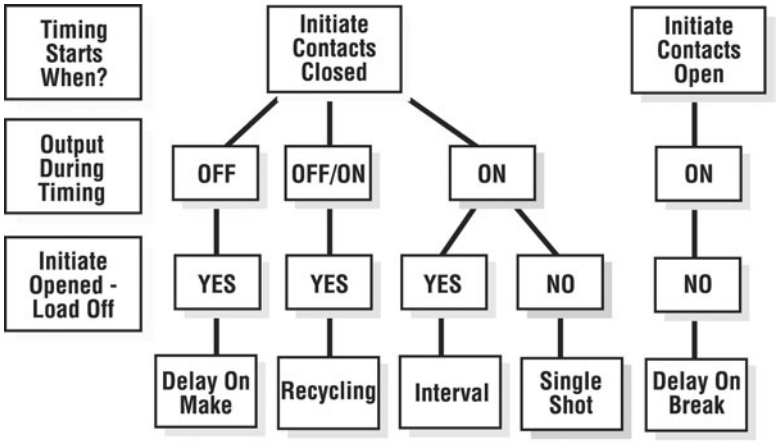
Selection Questions

1) The timing starts when the initiate (starting) contacts are:
   A) Closed  B) Opened

2) What is the status of the output (or load) during timing:
   A) On  B) Off  C) On/Off

3) Will the load de-energize (or remain de-energized) if the initiate (starting) contacts are opened during timing:
   A) Yes  B) No

THE FIVE MOST USED FUNCTIONS

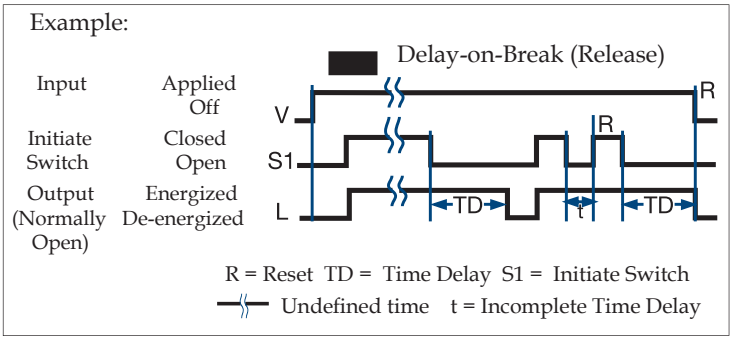



## Understanding Time Diagrams

Time diagrams are used to show the relative operation of switches, controls, and loads as time progresses. Time begins at the first vertical boundary. There may be a line indicating the start of the operation or it may just begin with the transition of the device that starts the operation. Each row in the time diagram represents a separate component. These rows will be labeled with the name of the device or its terminal connection numbers. In a bistable or digital system, the switches, controls, or loads can only be ON or OFF. The time lines are drawn to represent these two possible conditions. Vertical lines are used to define important starting or ending points in the operation.

The example to the right is the most common type of time diagram in use in North America. It shows the energizing of loads, and the closing of switches and contacts by an ascending vertical transition of the time line. Opening switches or contacts or de-energizing loads are represented by descending vertical transitions.

TIME DIAGRAM

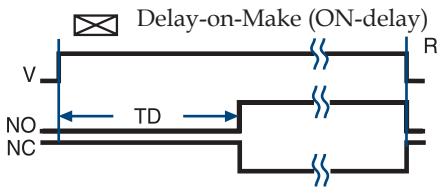


## INTERNATIONAL TIMING FUNCTION SYMBOLS

= Delay-on-Make; ON-delay
= Delay-on-Break; OFF-delay
= Delay-on-Make & Break; ON and OFF-delay
= Interval; Impulse-ON
= Trailing Edge Interval; Impulse-OFF
= Single Shot; Pulse Former
= Flasher - ON Time First; Recycling Equal Times - ON First
= Flasher - OFF Time First; Recycling Equal Times - OFF First
= Recycling - Unequal Times; Pulse Generator
= Recycling - Unequal Times Starting with ON or OFF
= Delay-on-Make & Interval; Single Pulse Generator

### Delay-on-Make: (ProgramaCube® Function M)

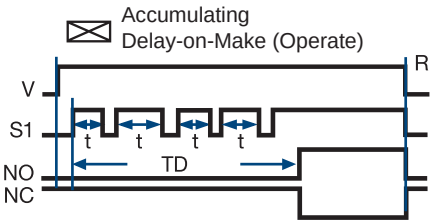
(ON-delay, Delay on Operate, On Delay, Operate Delay, Delay On, Prepurge Delay)
OPERATION: Upon application of input voltage, the time delay begins. The output (relay or solid state) is de-energized before and during the time delay. At the end of the time delay, the output energizes and remains energized until input voltage is removed.
RESET: Removing input voltage resets the time delay and output.
See: HRPS, KRPS, KSPS, KSPU, NHPS, NHPU, TDM, TRDU




Extra Functions Included in Some Delay-on-Make (DOM) Timers:

### Accumulating Time Delay Feature: (ProgramaCube® Function AM)

Some DOM timers allow the time delay to be stopped and held and then resumed by opening and closing an external switch. The total time delay, TD is the sum of the accumulated partial time delays, "t".
See: KRPD, KRPS, HRPS, NHPS, KSPD, KSPS, TRDU

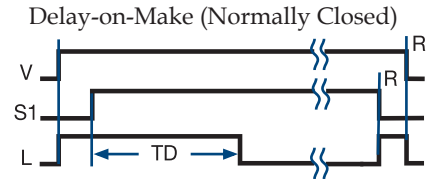


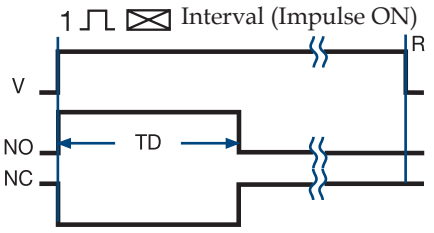

### Instantaneous Contacts:

Some DOM timers have a set of instantaneous contacts in addition to the delayed contacts. Instantaneous contacts energize when input voltage is applied and remain until voltage is removed.

### Delay-on-Make, Normally Closed Output:

All relay output delay-on-make timers with normally closed contacts include this function. (See Delay-on-Make NC Contacts) This function is also available in solid-state output timers. The solid-state output energizes when input voltage is applied. The time delay begins when an optional initiate switch S1 is closed (timing starts when voltage is applied if S1 is not used). The output de-energizes at the end of the time delay.
Reset: Opening S1 resets the time delay and the output immediately energizes (or remains energized). Removing input voltage resets the time delay and de-energizes the output.
See: KSD4, THD4, TS4, TSD4




### Interval: (ProgramaCube® Function I)

(Impulse-ON, Single Pulse on Operate, On Interval, Interval On, Pulse Shaping, Bypass Timing)
OPERATION: Upon application of input voltage, the time delay begins. The output (relay or solid state) energizes during the time delay. At the end of time delay the output de-energizes and remains de-energized until input voltage is removed.
RESET: Removing input voltage resets the time delay and output.
See: HRPS, KRPS, KSPS, KSPU, NHPS, NHPU, TDI, TSD2

Extra Functions Included on Some Interval Timers:

### Instantaneous Contacts:

Some Interval timers have a set of intantaneous contacts in addition to the delayed contacts. Intantaneous contacts energize when input voltage is applied and remain until voltage is removed.

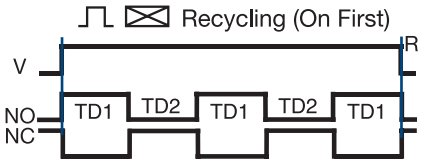
### Legend

V = Voltage
R = Reset
TD = Time Delay
S1 = Initiate Switch
NO = Normally Open Contact
NC = Normally Closed Contact
t = Incomplete (Partial) Time Delay
L = Load
= Undefined time

# Timer Functions
# Popular Functions

## Recycling: (ProgramaCube®Functions RE, RD, RXE, RXD)

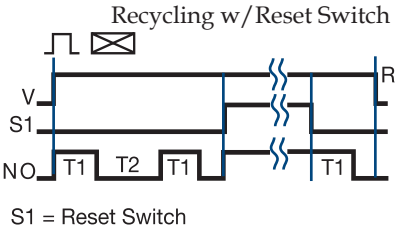
(Flasher, Pulse Generator, Recycle Timing, Repeat Cycle, Duty Cycling)
OPERATION: Upon application of input voltage, the output (relay or solid state) energizes and the ON time begins. At the end of the ON time, the output de-energizes and the OFF time begins. At the end of the OFF time, the output energizes and the cycle repeats as long as input voltage is applied. The OFF time may be the first delay in some recycling timers.
RESET: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.
The time delays in some recycling timers are equal TD1=TD2. Flashers are an example of this type of recycling timer. Others have separately selectable time delays.
See: HRPD, HRPS, KRPD, KRPS, KSPD, KSPS, KSPU, NHPD, NHPS, NHPU, TDR




Extra Functions Included in Some Recycling Timers:

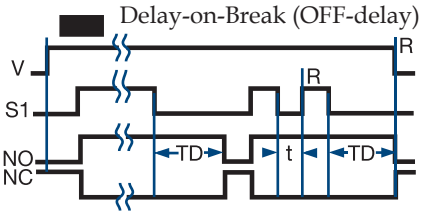
### Instantaneous Contacts:

Some Recycling timers have a set of instantaneous contacts in addition to the delayed contacts. Instantaneous contacts energize when input voltage is applied and remain until voltage is removed.
RESET SWITCH: Closing an external switch transfers the output and resets the sequence to the first delay.
See: HRDR




## Delay-on-Break: (ProgramaCube® Function B)

(Delay on Release, OFF-delay, Release Delay, Postpurge Delay)
OPERATION: Input voltage must be applied before and during timing. Upon closure of the initiate switch, the output (relay or solid state) energizes. The time delay begins when the initiate switch is opened. The output remains energized during timing. At the end of the time delay, the output de-energizes. The output will energize if the initiate switch is closed when input voltage is applied.
RESET: Reclosing the initiate switch during timing resets the time delay. Removing input voltage resets the time delay and output.
See: HRPS, HRPU, KRPS, KSPS, KSPU, NHPS, NHPU, TRDU, TDB




Extra Functions Included in Some Delay-on-Break (DOB) Timers:

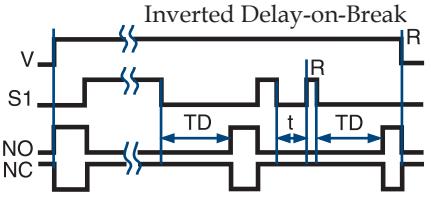
### Instantaneous Contacts:

Some DOB timers have a set of instantaneous contacts in addition to the delayed contacts. Instantaneous contacts energize when input voltage is applied and remain until voltage is removed.

Related Functions:

## Inverted Delay-on-Break: (ProgramaCube® Function UB)

OPERATION: Input voltage must be applied before and during timing. Upon closure of the initiate switch S1, the output (relay or solid state) de-energizes. The time delay begins when S1 is opened. The output remains de-energized during timing. At the end of the time delay, the output energizes. The output remains de-energized if S1 is closed when input voltage is applied
RESET: Reclosing S1 during timing resets the time delay. Removing input voltage resets the time delay and output.
See: HRPS, HRPU, KRPS, KSPS, KSPU, NHPS, NHPU, TRDU

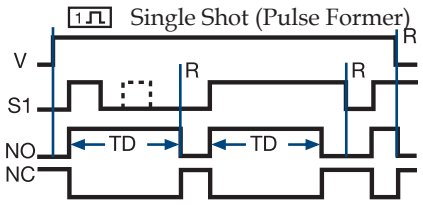



### Legend

| | |
|---|---|
| V = Voltage | NO = Normally Open Contact |
| R = Reset | NC = Normally Closed Contact |
| T1 = ON Time | t = Incomplete Time Delay |
| T2 = OFF Time | TD, TD1, TD2 = Time Delay |
| S1 =Initiate Switch | = Undefined Time |

## Single Shot: (ProgramaCube® Functions S or SD)

(Pulse Former, One Shot Relay, Single Shot Interval, Pulse Shaping)
OPERATION: Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch, the output (relay or solid state) energizes and the time delay begins. At the end of the delay, the output de-energizes. Opening or reclosing the initiate switch during timing has no effect on the time delay. Note (for most single shot timers): If the initiate switch is closed when input voltage is applied, the output energizes and the time delay begins.
RESET: Reset occurs when the time delay is complete and the initiate switch is opened. Removing input voltage resets the time delay and output.
See: HRPS, HRPU, KRPS, KSPS, KSPU, NHPS, NHPU, TDS, TSDS, TRDU




Extra Functions Included in Some Single Shot Timers:

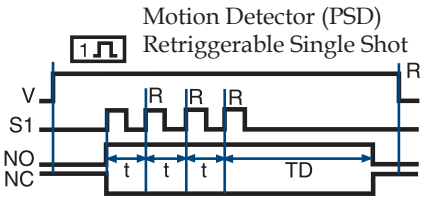
### Instantaneous Contacts:

Some Single Shot timers have a set of instantaneous contacts in addition to the delayed contacts. Instantaneous contacts energize when input voltage is applied and remain until voltage is removed.

Related Functions:

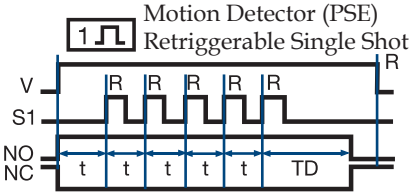
## Retriggerable Single Shot (Motion Detector): (ProgramaCube® Function PSD)

(Motion Detector, Zero Speed Switch, Watchdog Timer, Missing Pulse Timer)
OPERATION: Input voltage must be applied prior to and during timing. The output (relay or solid state) is de-energized. When the initiate switch S1 closes momentarily or maintained, the output energizes and the time delay begins. Upon completion of the delay, the output de-energizes.
RESET: Reclosing S1 resets the time delay and restarts timing. Removing input voltage resets the time delay and output.
See: HRD9, HRPS, HRPU, KRD9, KRPS, KSPS, KSPU, NHPS, NHPU, TRDU, TRU



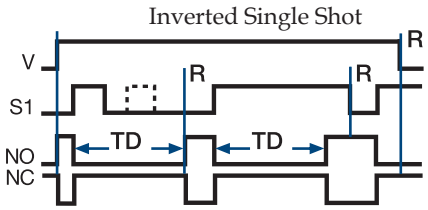

## Retriggerable Single Shot (Motion Detector): (ProgramaCube® Function PSE)

OPERATION: Similar to retriggerable single shot function PSD above except, when input voltage is applied, the output (relay or solid state) immediately energizes and timing begins. At the end of the time delay, the output de-energizes. The unit will timeout as long as S1 remains open or closed for a full time delay period.
RESET: During timing, reclosing S1 resets and restarts the time delay and the output remains energized. After timeout, reclosing S1 starts a new operation. Removing input voltage resets the time delay and the output.
See: KRD9



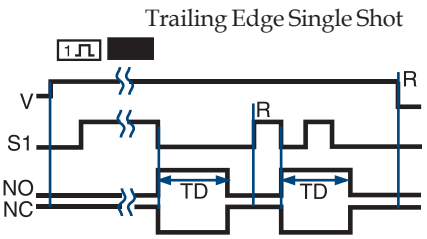

## Inverted Single Shot: (ProgramaCube® Function US)

OPERATION: Input voltage must be applied before and during timing. Upon momentary or maintained closure of the initiate switch S1, the output (relay or solid state) de-energizes. At the end of the time delay, the output energizes. Opening or reclosing S1 during timing has no affect on the time delay. The output will remain de-energized if S1 is closed when input voltage is applied.
RESET: Reset occurs when the time delay is complete and S1 is open. Removing input voltage resets the time delay and output.
See: HRPS, HRPU, KRPS, KSPS, KSPU, NHPS, NHPU, TRDU




## Trailing Edge Single Shot (Impulse-OFF): (ProgramaCube® Function TS)

OPERATION: Input voltage must be applied before and during timing. When the initiate switch S1 opens, the output (relay or solid state) energizes. At the end of the time delay, the output de-energizes. Reclosing and opening S1 during timing has no affect on the time delay. The output will not energize if S1 is open when input voltage is applied.
RESET: Reset occurs when the time delay is complete and S1 is closed. Removing input voltage resets the time delay and output.See: HRPS, KRPS, KSPS, KSPU, NHPU, TRDU



## Timer Functions
## Two Functions in One Timer

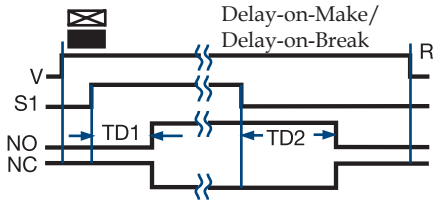
### Delay-on-Make/Delay-on-Break: (ProgramaCube® Function MB)

(ON-delay/OFF-delay, Delay on Operate/Delay on Release, Sequencing ON & OFF, Fan Delay, Prepurge & Postpurge)

OPERATION: Input voltage must be applied at all times. The output (relay or solid state) is de-energized. Upon closure of the S1 initiate switch, the delay-on-make time delay (TD1) begins. At the end of TD1, the output (relay or solid state) energizes. Opening S1 starts the delay-on-break time delay (TD2). At the end of TD2, the output de-energizes.

RESET: Removing input voltage resets time delays and the output.If S1 is a) opened during TD1, then TD1 is reset and the output remains de-energized. b) reclosed during TD2, then TD2 is reset and the output remains energized.

See: HRPD, KRPD, KSPD, NHPD




Extra Functions Included in Some Delay-on-Make/Delay-on-Break Timers:

#### Instantaneous Contacts:

Some DOM/DOB timers have a set of instantaneous contacts in addition to the delayed contacts. Instantaneous contacts energize when input voltage is applied and remain until voltage is removed.

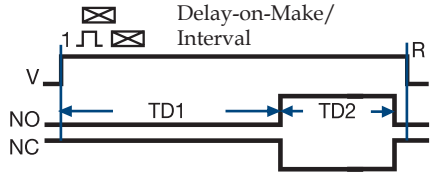
### Delay-on-Make/Interval: (ProgramaCube® Function MI)

(Single Pulse Generator, Delayed Interval, Delay on Operate/Single Pulse on Operate)

OPERATION: Upon application of input voltage, the delay-on-make time delay (TD1) begins, the output remains de-energized. At the end of this delay, the output (relay or solid state) energizes and the interval delay (TD2) begins. At the end of the interval delay (TD2), the output de-energizes.

RESET: Removing input voltage resets the output, the time delays and returns the sequence to the first delay.

See: ESD5, HRPD, KRPD, KSPD, NHPD, TRDU

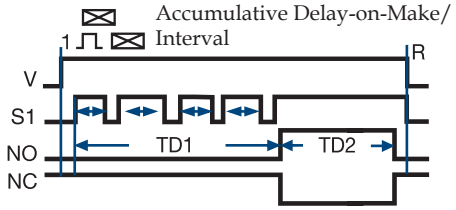



### Accumulative Delay-on-Make/Interval: (ProgramaCube® Function AMI)

OPERATION: Input voltage must be applied before and during timing. The output is de-energized before and during the TD1 time delay. Each time S1 closes, the time delay progresses; when it opens, timing stops. When the amount of time S1 is closed equals the full TD1 delay, the output (relay or solid state) energizes for TD2. Upon completion of TD2, the output relay de-energizes. Opening S1 during TD2 has no affect.

RESET: Removing input voltage resets the time delay, output relay, and the sequence to the first delay.

See: HRPD, KRPD, KSPD, NHPD




#### Legend

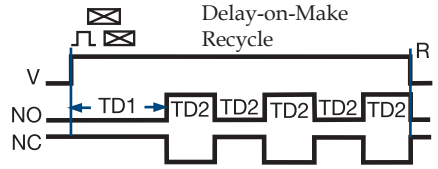
| | |
|---|---|
| V = Voltage | TD1, TD2 = Time Delay |
| S1 = Initiate Switch | NO = Normally Open |
| R = Reset | NC = Normally Closed |

⟅⟆ = Undefined Time

# Timer Functions
# Two Functions in One Timer

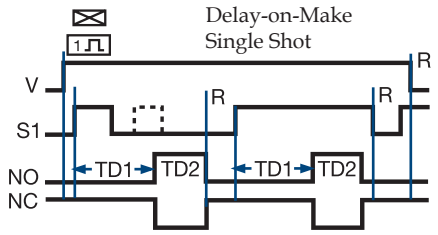
## Delay-on-Make/Recycle: (ProgramaCube® Function MRE)

OPERATION: Upon application of input voltage, TD1 begins and the output (relay or solid state) remains de-energized. At the end of TD1, the TD2 recycle function begins and the output (relay or solid state) cycles ON and OFF for equal delays. This cycle continues until input voltage is removed.
RESET: Removing input voltage resets the output and time delays, and returns the sequence to the first delay.
See: KSPD, KRPD, NHPD, HRPD, TRDU



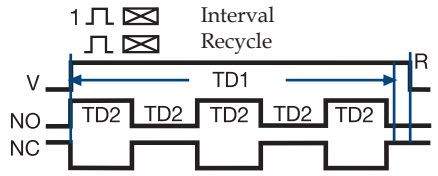

## Delay-on-Make/Single Shot: (ProgramaCube® Function MS)

OPERATION: Upon application of input voltage and the closure of S1, TD1 begins and the output (relay or solid state) remains de-energized. The output (relay or solid state) energizes at the end of TD1, and TD2 begins. At the end of TD2, the output (relay or solid state) de-energizes. Opening or reclosing S1 during timing has no affect on the time delays.
RESET: Reset occurs when the time delay is complete and S1 is open. Removing input voltage resets the time delay, output, and the sequence to the first delay.
See: KSPD, KRPD, NHPD, HRPD, TRDU



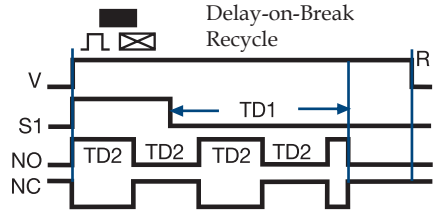

## Interval/Recycle: (ProgramaCube® Function IRE)

OPERATION: Upon application of input voltage TD1 begins. At the same time, the TD2 ON time begins and the output (relay or solid state) energizes. At the end of the ON time, the TD2 OFF time begins and the output de-energizes. The equal ON time OFF time cycle continues until TD1 is completed at which time the output de-energizes.
RESET: Removing input voltage resets the time delays, output, and the sequence to the Interval function.
See: KSPD, KRPD, NHPD, HRPD, TRDU



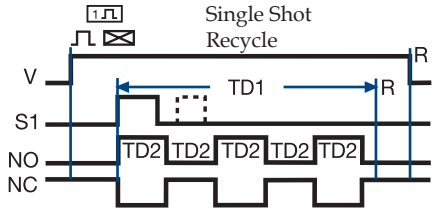

## Delay-on-Break/Recycle: (ProgramaCube® Function BRE)

OPERATION: Upon application of input voltage and the closure of S1, the TD2 ON time begins and the output (relay or solid state) energizes. Upon completion of the ON time, the output de-energizes for the TD2 OFF time. At the end of the OFF time, the equal ON/OFF cycle repeats. When S1 opens, the TD1 delay begins. TD1 and TD2 run concurrently until the completion of TD1 at which time, the TD2 ON/OFF cycle terminates and the output de-energizes. The output energizes if S1 is closed when input voltage is applied.
RESET: Reclosing S1 during timing resets the TD1 time delay. Removing input voltage resets the time delay, output, and the sequence to the Delay-on-Break function.
See: KSPD, KRPD, NHPD, HRPD, TRDU



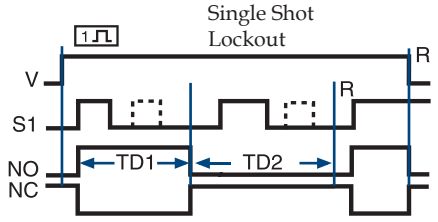

## Single Shot/Recycle: (ProgramaCube® Function SRE)

OPERATION: Upon application of input voltage and the closure of S1, TD1 begins. At the same time, the TD2 ON time begins and the output (relay or solid state) energizes. Upon completion of the ON time, the output de-energizes for the TD2 OFF time. At the end of the OFF time, the equal ON/OFF cycle repeats. TD1 and TD2 run concurrently until the completion of TD1 at which time, the TD2 ON/OFF cycle terminates and the output de-energizes. Opening or reclosing S1 during timing has no affect on the time delays. The output will energize if S1 is closed when input voltage is applied.
RESET: Removing input voltage resets the time delay, output, and the sequence to the first delay.
See: HRPD, KRPD, KSPD, NHPD, TRDU



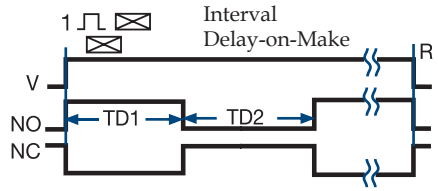

## Single Shot/Lockout: (ProgramaCube® Function SL)

OPERATION: Upon application of input voltage and momentary or maintained closure of S1, the output (relay or solid state) energizes and TD1 single shot time delay begins. The output relay de-energizes at the end of TD1 and the TD2 lockout time delay begins. During TD2 (and TD1) closing switch S1 has no effect on the operation. After TD2 is complete, closing S1 starts another operation. If S1 is closed when input voltage is applied, the output energizes and the TD1 time delay begins.
RESET: Removing input voltage resets the time delays and the output and returns the cycle to the first delay.




## Interval/Delay-on-Make: (ProgramaCube® Function IM)

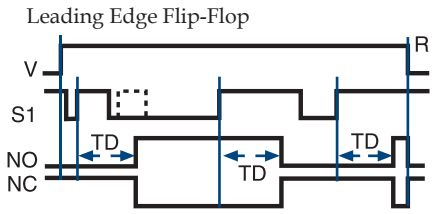
OPERATION: Upon application of input voltage, the output (relay or solid state) energizes and TD1 begins. At the end of TD1, the output de-energizes and TD2 begins. At the end of TD2, the output energizes.
RESET: Removing input voltage resets the time delays, output, and the sequence to the first delay.
See: HRPD, KRPD, KSPD, NHPD, TRDU



# Timer Functions
# Counting and Switching Functions

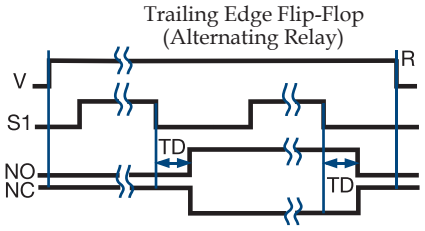
## Leading edge flip-flop: (ProgramaCube® Function F)

OPERATION: Input voltage must be applied before and during operation. The operation begins with the output (relay or solid state) de-energized. Upon momentary or maintained closure (leading edge triggered) of the initiate switch S1, the time delay begins. At the end of the time delay, the output energizes and remains energized. Opening or re-closing S1 during timing has no affect. After the output transfers, the next closure of S1 starts a new operation. Each time an S1 closure is recognized, the time delay occurs and then the output transfers, ON to OFF, OFF to ON, ON to OFF. The first operation will occur if S1 is closed when input voltage is applied.
RESET: Removing input voltage resets the time delay and the output to the de-energized state.
Function can be applied to ProgramaCube Series: HRPS, KRPS, KSPS



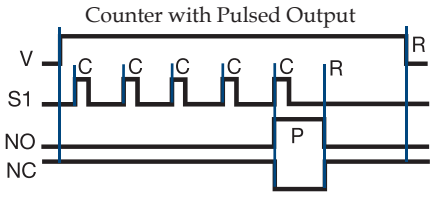

## Alternating Relay (Trailing edge flip-flop): (ProgramaCube® Function FT)

OPERATION: Input voltage must be applied at all times for proper operation. The operation begins with the output (relay or solid state) de-energized. Closing S1 enables the next alternating operation. When S1 opens (trailing edge triggered), the time delay begins. At the end of the time delay, the output energizes and remains energized until S1 is (re-closed and) re-opened. Then the output relay de-energizes and remains until S1 opens again. Each time S1 opens the time delay occurs and the output transfers.
RESET: Removing input voltage resets the output and the time delay.
See: ARP, HRPS, KRPS



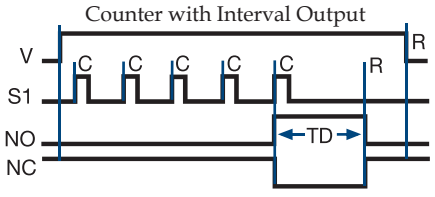

## Counter with Pulsed Output: (ProgramaCube® Function C)

Function Limited to Switch Adjustable ProgramaCubes®
OPERATION: Input voltage must be applied before and during operation. Each time S1 is closed, a count is added. When the total number of S1 closures equals the total count selected on the unit, the output energizes. The output remains energized for the pulse duration specified for the product, and then de-energizes. If S1 is closed while the output is energized, a count is not added. If S1 is closed when input voltage is applied, a count is not added.
RESET: The unit automatically resets at the end of each operation. Removing input voltage resets the output, counter, and pulse delay.
See: HRPU, KSPU, NHPU




## Counter with Interval Output: (ProgramaCube® Function CI)

Function Limited to Switch Adjustable ProgramaCubes®
OPERATION: Input voltage must be applied before and during operation. Each time S1 is closed, a count is added. When the total number of S1 closures equals the total count selected on the unit, the output energizes and the interval time delay begins. The output de-energizes at the end of the time delay. If S1 is closed during the time delay, a count is not added. If S1 is closed when input voltage is applied, a count is not added.
RESET: The counter is reset during the time delay, the unit automatically resets at the end of the interval time delay. Removing input voltage resets the output, counter, and time delay.
See: HRPU, HRV, HSPZ, KSPU, NHPU




### Legend
V = Voltage
R = Reset
S1 = Initiate Switch
Td, TD1, TD2 = Time Delay
NO = Normally Open Contact
NC = Normally Closed Contact
C = Count
P = Pulse Duration
—⫽— = Undefined Time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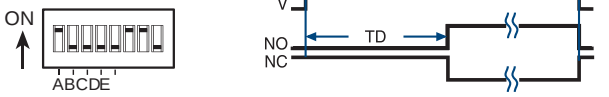
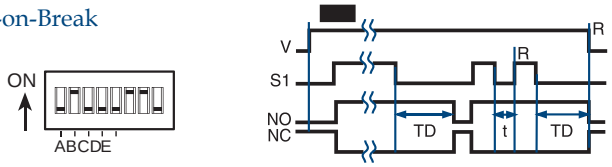
## TRDU Function Diagrams

### Single Functions

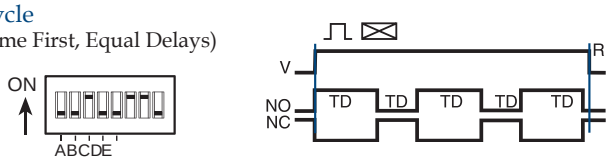
* Delay-on-Make



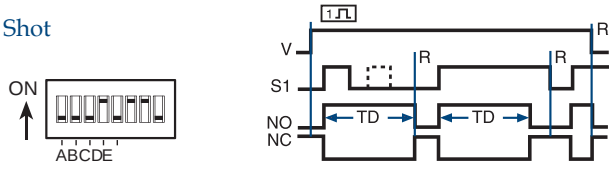

Delay-on-Break



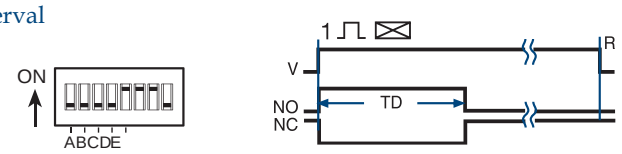

* Recycle
(ON Time First, Equal Delays)



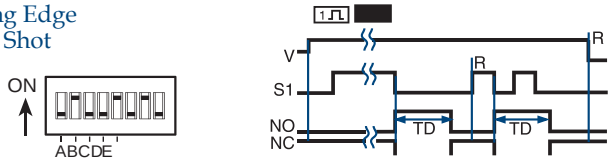

Single Shot



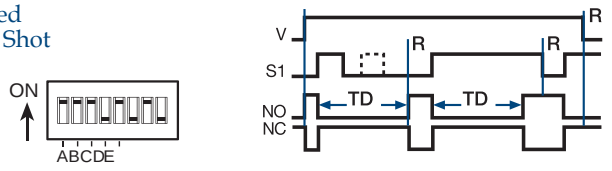

* Interval



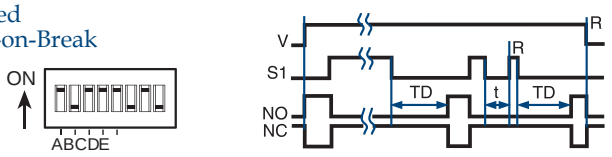

Trailing Edge
Single Shot




Inverted
Single Shot

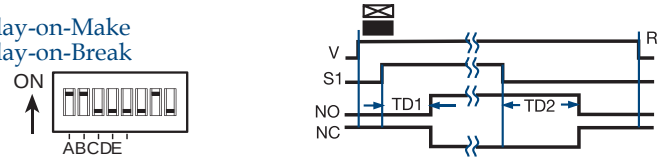



Inverted
Delay-on-Break

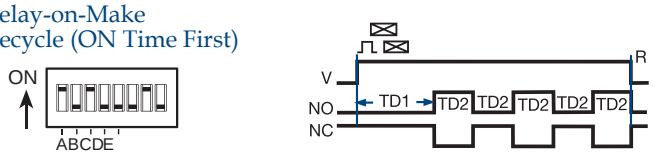



### Dual Functions

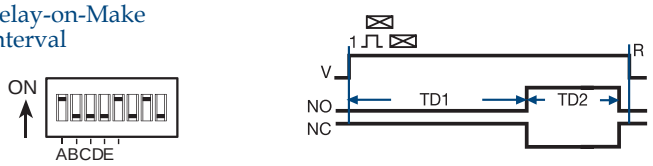
Delay-on-Make
Delay-on-Break



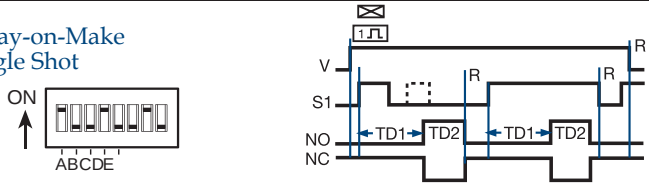

* Delay-on-Make
Recycle (ON Time First)



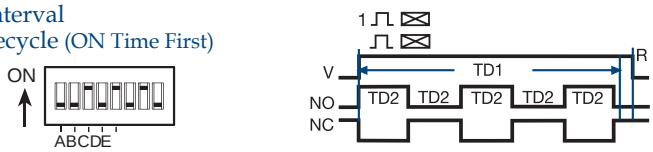

* Delay-on-Make
Interval



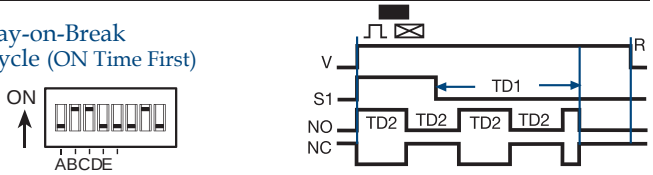

Delay-on-Make
Single Shot



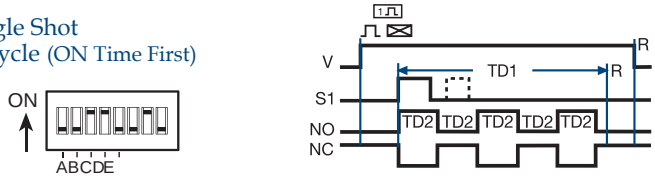

* Interval
Recycle (ON Time First)



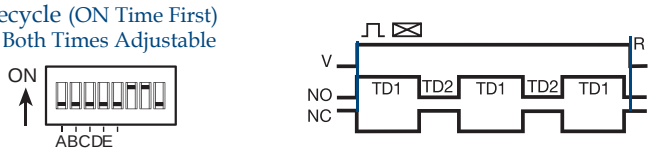

Delay-on-Break
Recycle (ON Time First)




Single Shot
Recycle (ON Time First)




* Recycle (ON Time First)
Both Times Adjustable



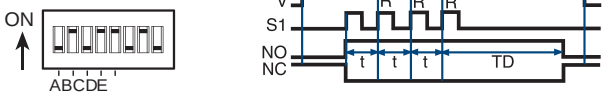

* 9 Functions included in the 8 pin DPDT models

Continued on next page...

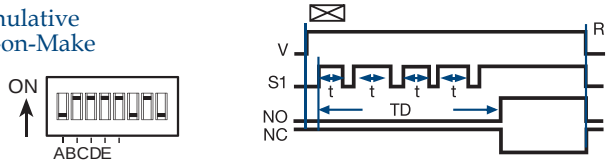
# Appendix A - Timer/Flasher Functions

## Single Functions

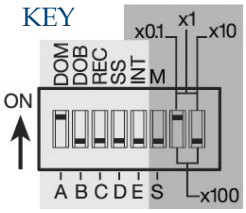
### Retriggerable Single Shot




### Accumulative Delay-on-Make




### KEY



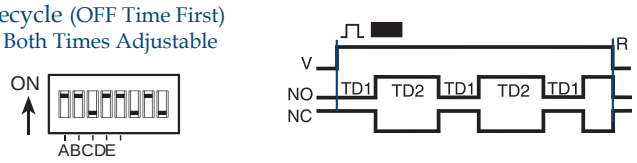

V=Voltage, R=Reset, S1=Initiate Switch, NO=Normally Open Contact, NC=Normally Closed Contact, TD,TD1,TD2=Complete Time Delay, t=Partial Time Delay, DOM=Delay-on-Make, DOB=Delay-on-Break, REC=Recycle, SS=Single Shot, INT=Interval, M=Minutes, S=Seconds, ≠ Undefined time

5 Switches for Function Selection
3 Switches for Time Delay Range

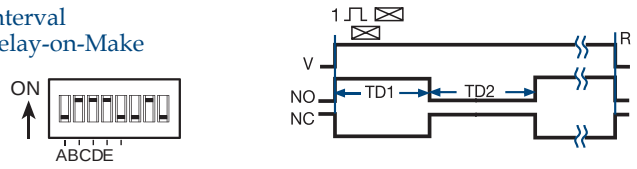
NOTE: The time delay range is the same for both functions when dual functions are selected.

## Dual Functions

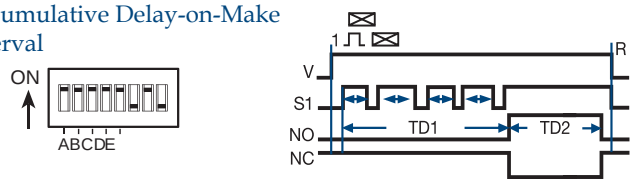
### * Recycle (OFF Time First) Both Times Adjustable




### * Interval Delay-on-Make



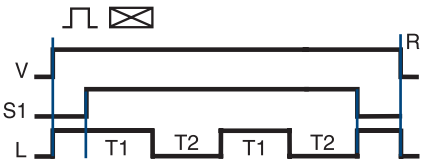

### Accumulative Delay-on-Make Interval




* 9 Functions included in the 8 pin DPDT models

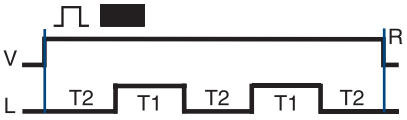
## Flasher Function Diagrams

### Flasher (NC)



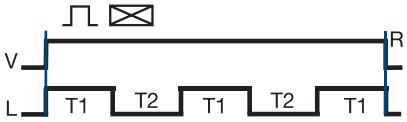

V = Voltage S1 = Initiate Switch L = Load
R = Reset T1 = ON Time T2 = OFF Time
T1 ≅ T2

### Flasher (OFF First)



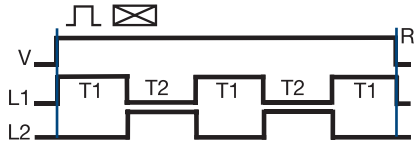

V = Voltage R = Reset L = Load
T1 = ON Time T2 = OFF Time
T1 ≅ T2

### Flasher (ON First)



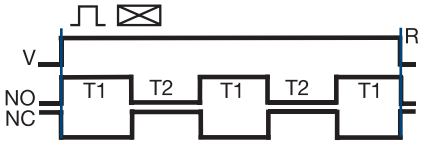

V = Voltage R = Reset L = Load
T1 = ON Time T2 = OFF Time T1 ≅ T2
ON time plus OFF time equals one complete flash.

### Flasher (Alternating)



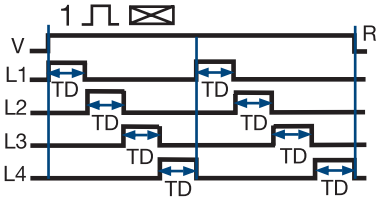

V = Voltage L1 = Load 1 L2 = Load 2
R = Reset T1 = ON Time T2 = OFF Time
T1 ≅ T2

### Flasher (ON First-DPDT)




V = Voltage R = Reset
T1 = ON Time T2 = OFF Time
NO = Normally Open NC = Normally Closed

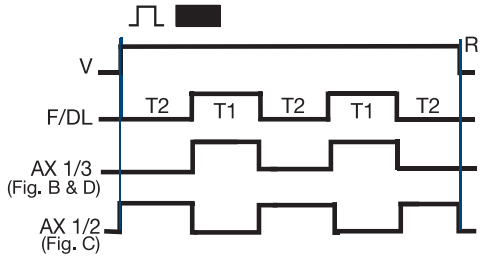
### Flasher (Chasing)




SC4 shown; SC3, L4 is eliminated and L1 TD begins as soon as L3 TD is completed.

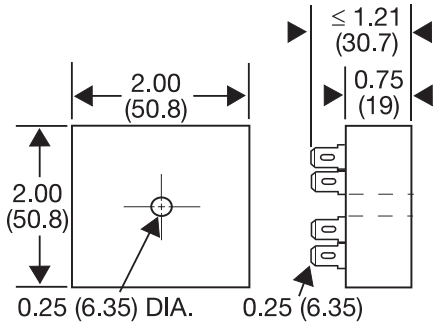
V = Voltage R = Reset L (1...4) = Lamps
TD = Time Delay (all are equal)

### Flashers & Aux. Modules



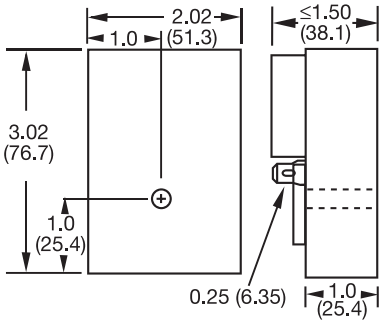

V = Voltage L = Load T1 = ON Time
T2 = OFF Time R = Reset
T1 ≅ T2

**FIGURE 1**



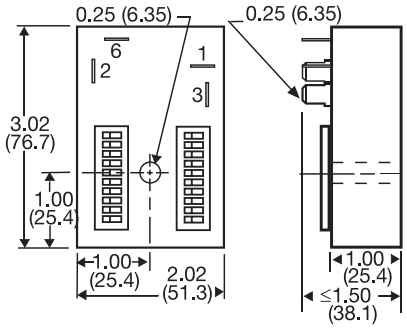

**CT; ESD5; ESDR; FS100; FS200; FS300; KRD3; KRD9; KRDB; KRDI; KRDM; KRDR; KRDS; KRPD; KRPS; KSD1; KSD2; KSD3; KSD4; KSDB; KSDR; KSDS; KSDU; KSPD; KSPS; KSPU; KVM; T2D; TA; TAC1; TAC4; TDU; TDUB; TDUI; TDUS; TL; TMV8000; TS1; TS2; TS4; TS6; TSB; TSD1; TSD2; TSD3; TSD4; TSD6; TSD7; TSDB; TSDR; TSDS; TSS; TSU2000**

**FIGURE 2**



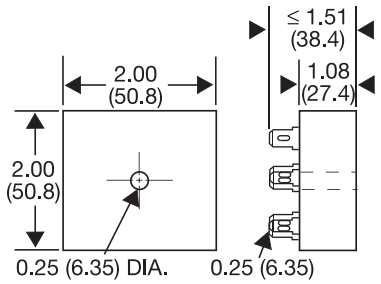

**HLV; HRD3; HRD9; HRDB; HRDI; HRDM; HRDR; HRDS; HRID; HRIS; HRIU; HRPD; HRPS; HRPU; HRV; RS**

**FIGURE 3**




**HSPZ**

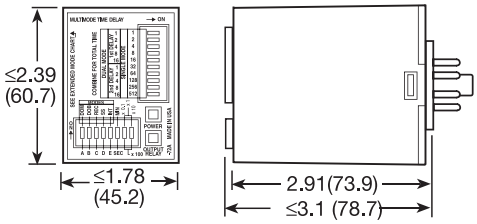
**FIGURE 4**




**FA; FS; FSU1000*; NHPD; NHPS; NHPU; NLF1*; NLF2*; PHS*; PTHF*; SIR1; SIR2; SLR1*; SLR2*; TH1; TH2; THC; THD1; THD2; THD3; THD4; THD7; THDB; THDM; THDS; THS**

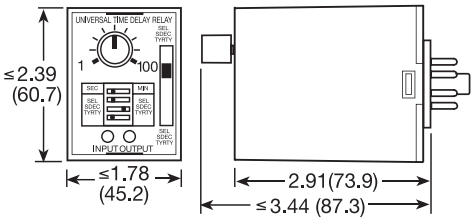
*If unit is rated @ 1A, see Figure 1

**FIGURE 5**



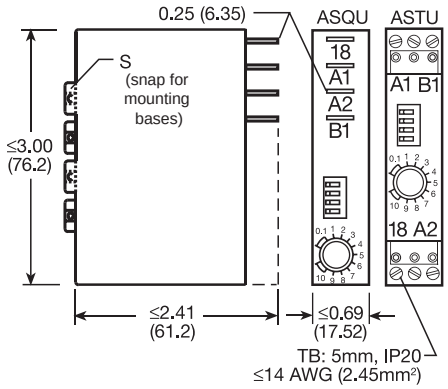

**TRDU**

**FIGURE 6**



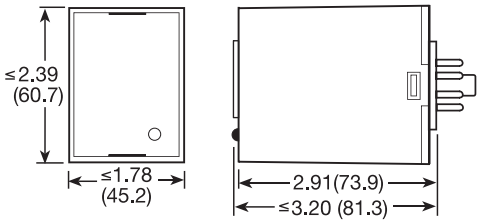

**TRU**

**FIGURE 7**



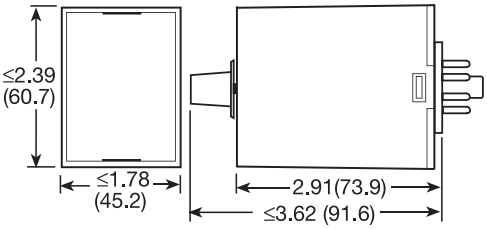

**ASQU; ASTU; DSQU; DSTU**

**FIGURE 8**



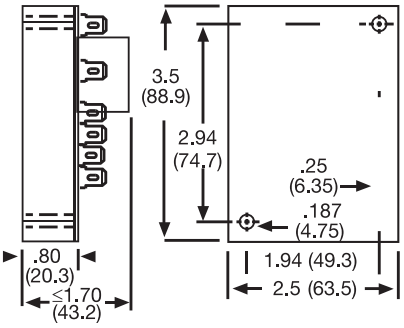

**PLM; PLR; TDB; TDBH; TDBL; TDI; TDIH; TDIL; TDM; TDMB; TDMH; TDML; TDR; TDS; TDSH; TDSL**

**FIGURE 9**



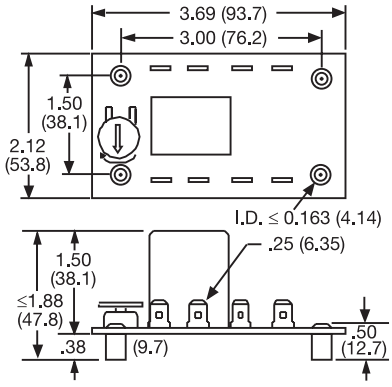

**FS500; PRLB; PRLM; PRLS; TRB; TRM; TRS**

**FIGURE 10**



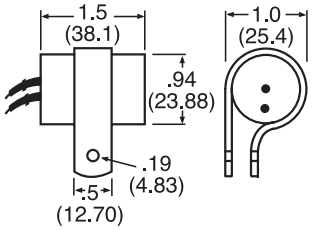

**ERD3; ERDI; ERDM**

**FIGURE 11**




**ORB; ORM; ORS**

**FIGURE 12**

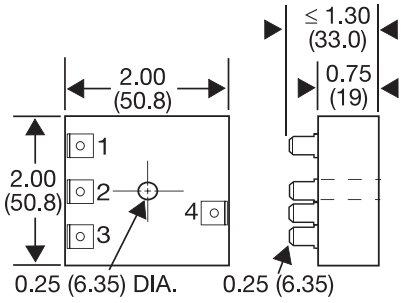



**FS100; FS400**

**inches (millimeters)**

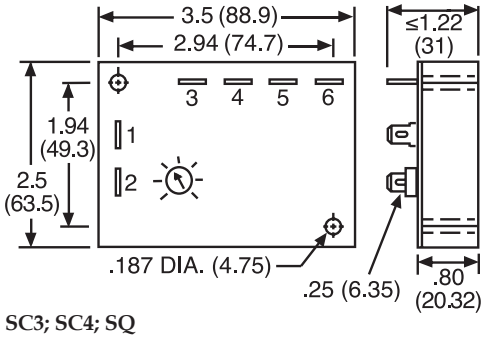
# Appendix B - Dimensional Drawings

**FIGURE 13**




**AF**

**FIGURE 14**




**SC3; SC4; SQ**

**FIGURE 15**

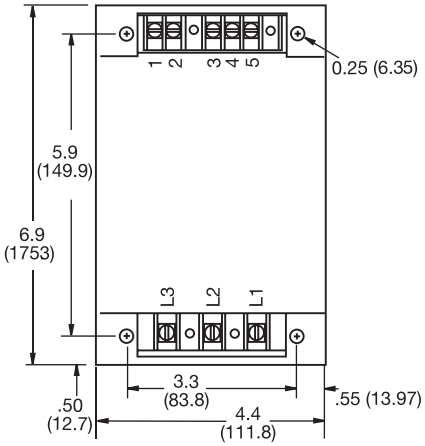
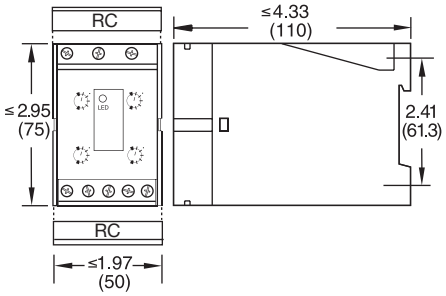
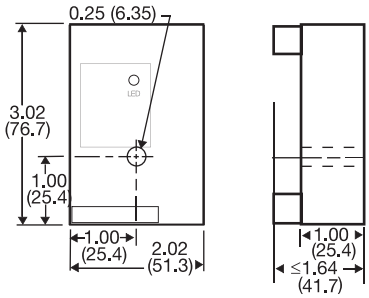



**FIGURE 16**

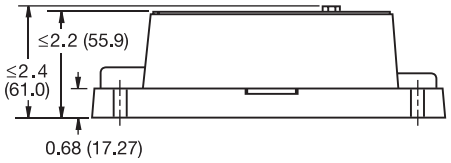



**DLMU**

**FIGURE 17**

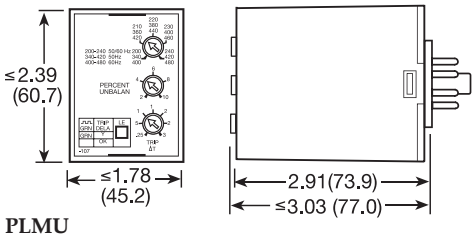



**FB9L; HLMU; SCR9L**



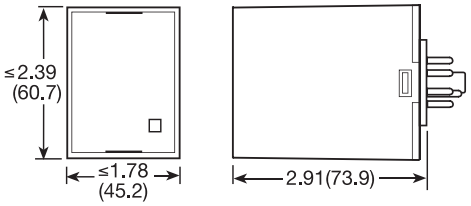

**WVM**

**FIGURE 18**



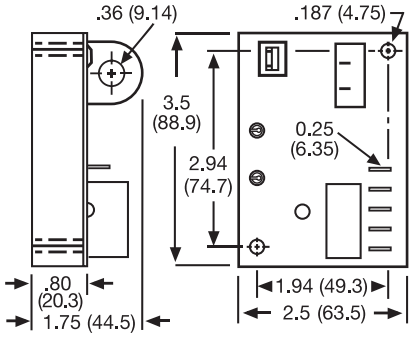

**PLMU**

**FIGURE 19**



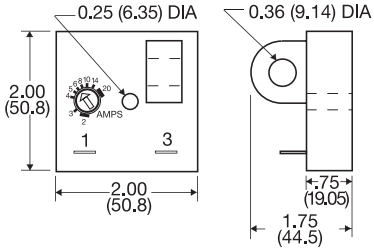

**LLC4; LLC6; PLS**

**FIGURE 20**



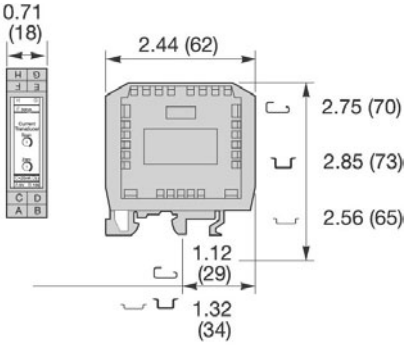

**ECS; ECSW** (ECS has spade connectors and ECSW has terminal board)

**FIGURE 21**



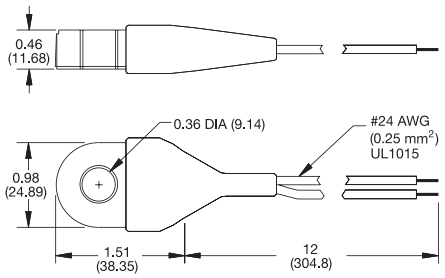

**TCS; TCSA**

**FIGURE 22**




**DCSA**

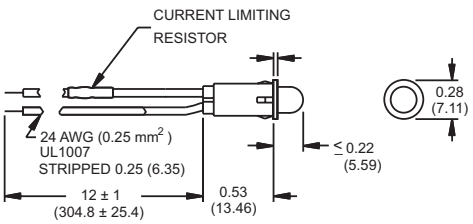
**FIGURE 23**




**LCS**

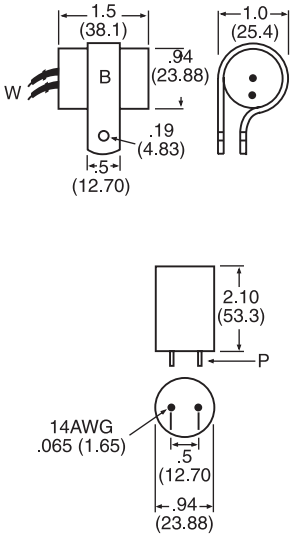
**inches (millimeters)**

## FIGURE 24



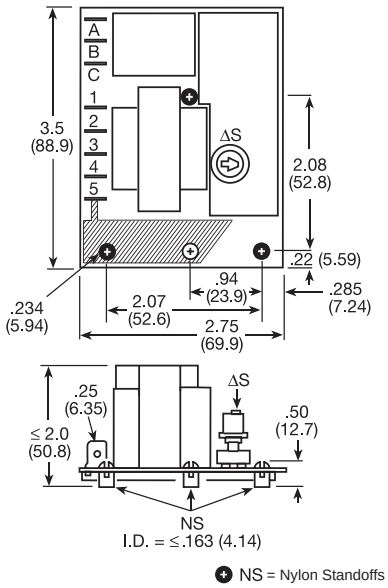

**LPM**

## FIGURE 25



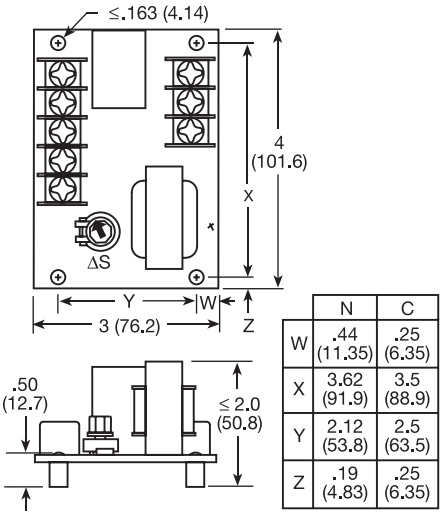

**MSM**

## FIGURE 26




**LLC1**

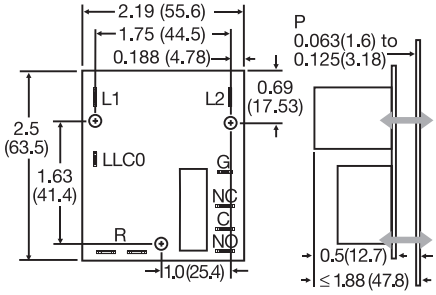
## FIGURE 27




| | N | C |
|---|---|---|
| W | .44 (11.35) | .25 (6.35) |
| X | 3.62 (91.9) | 3.5 (88.9) |
| Y | 2.12 (53.8) | 2.5 (63.5) |
| Z | .19 (4.83) | .25 (6.35) |

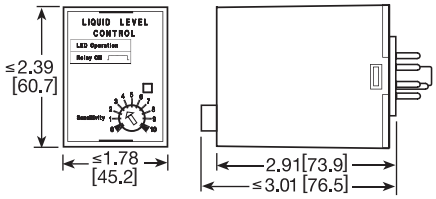
**LLC2**

## FIGURE 28



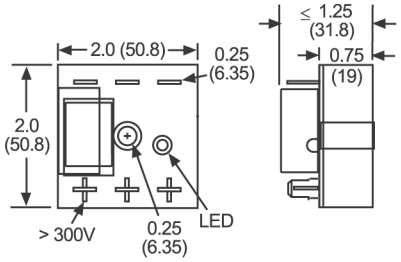

**LLC8**

## FIGURE 29



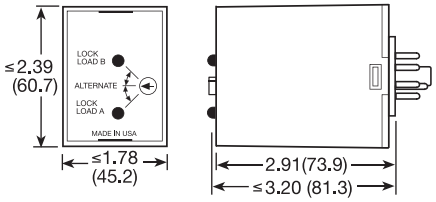

**LLC5**

## FIGURE 30



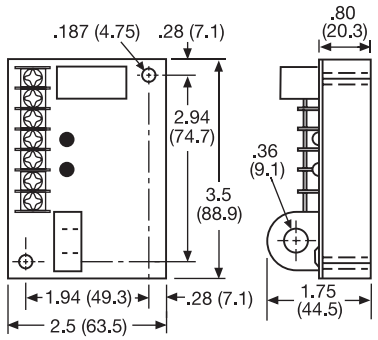

**TVM; TVW**

## FIGURE 31



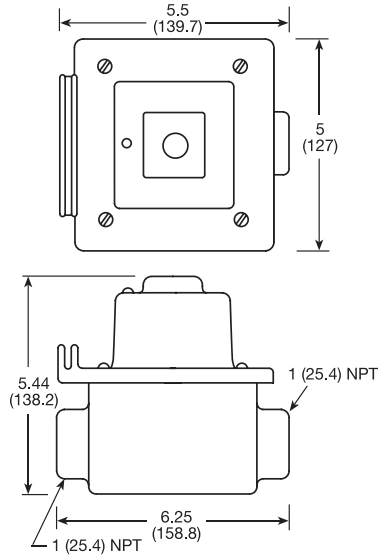

**ARP**

## FIGURE 32




**FB; SCR**

## FIGURE 33

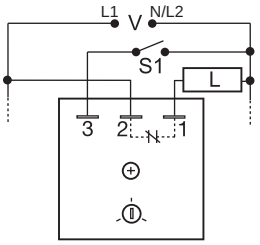



**PCR**

**inches (millimeters)**

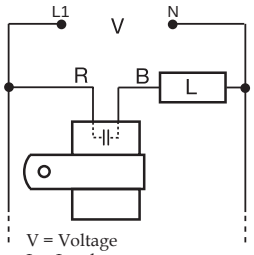
# Appendix C - Connection Diagrams

**FIGURE 1 - FSU1000 Series**



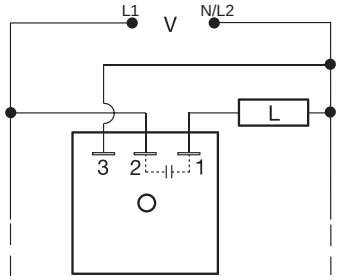

S1 = Optional low current switch
V = Voltage
L = Load

**FIGURE 2 - FS100 Series**



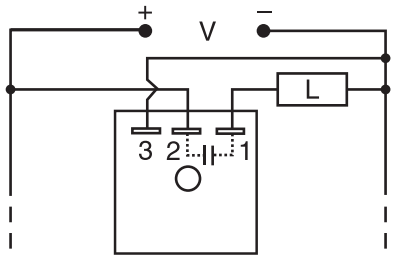

V = Voltage
L = Load
R = Red Wire
B = Black Wire

**FIGURE 3 - FS100 Series**



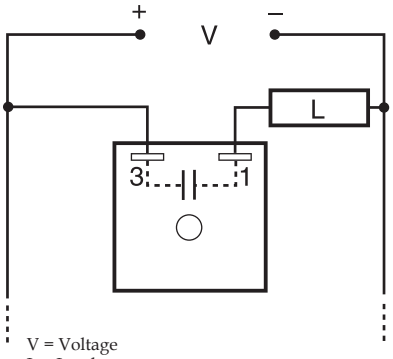

V = Voltage
L = Load

**FIGURE 4 - FS200 Series**



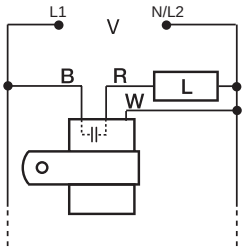

V = Voltage
L = Load

**FIGURE 5 - FS300 Series**



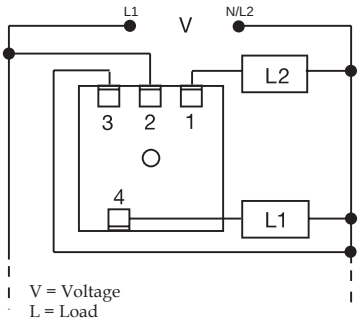

V = Voltage
L = Load
Note: Load may be in positive side.

**FIGURE 6 - FS400 Series**



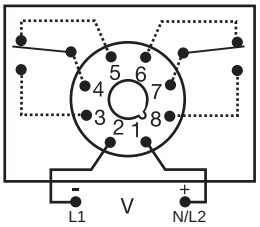

V = Voltage
L = Load
R = Red Wire
B = Black Wire
W= White Wire

**FIGURE 7 - AF Series**



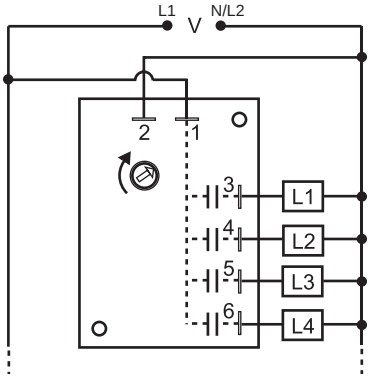

V = Voltage
L = Load

**FIGURE 8 - FS500 Series**



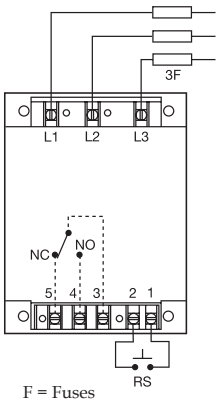

V = Voltage

**FIGURE 9 - SC3/SC4 Series**



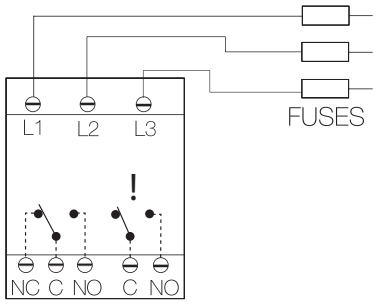

SC4 shown;
for SC3, terminal 6 & load L4 are eliminated.

**FIGURE 10 - WVM Series**



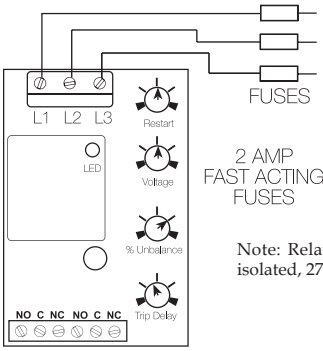

F = Fuses
NO = Normally Open
NC = Normally Closed
RS = Optional Remote Reset Switch
Relay contacts are isolated.
CAUTION:
2 amp max fast acting fuses must be installed externally in series with each input. (3)

**FIGURE 11 - DLMU Series**




L1, L2, L3 = Line Voltage Input
NO = Normally Open Contact
NC = Normally Closed Contact
C = Common, Transfer Contact
CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the DLMU.
! = Select alarm contact connection as N.O. or N.C. when ordering; N.O. Shown.

**FIGURE 12 - HLMU Series**

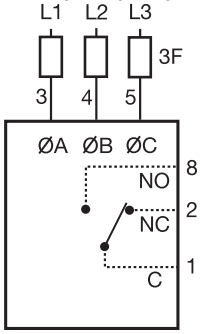



2 AMP
FAST ACTING
FUSES

Note: Relay contacts are isolated, 277VAC max.

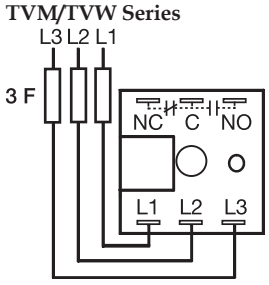
L1, L2, L3 = Line Voltage Input
NO = Normally Open Contact
NC = Normally Closed Contact
C = Common, Transfer Contact
CAUTION: 2 amp max. fast acting fuses are recommended to protect the equipment's wiring. They are not required to protect the HLMU.

**FIGURE 13 - PLMU/PLM/PLR/PLS Series**




F = Fuses
ØA = Phase A = L1
ØB = Phase B = L2
ØC = Phase C = L3
NO = Normally Open
NC = Normally Closed
2A fast acting fuses recommended for safety (not required)
Relay contacts are isolated.

**FIGURE 14 - TVM/TVW Series**




L1 = Phase A
L2 = Phase B
L3 = Phase C
NO = Normally Open
NC = Normally Closed
C = Common, Transfer Contact
Relay contacts are isolated.
F = 2A Fast acting fuses are recommended, but not required


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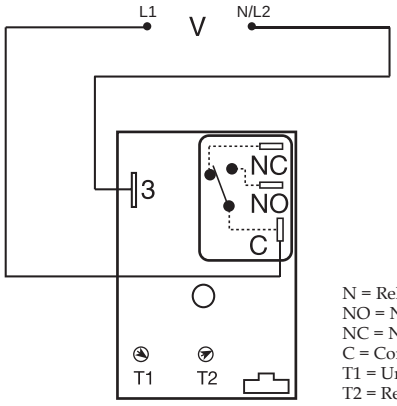
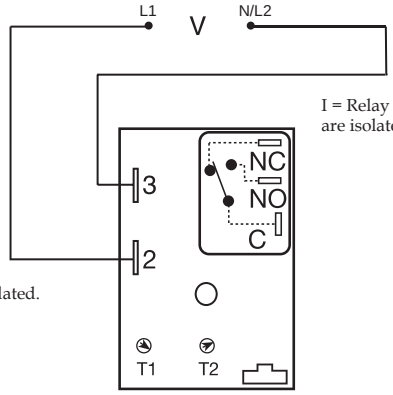
**FIGURE 15 - HLV Series**

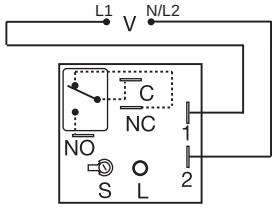



I = Relay contacts are isolated.

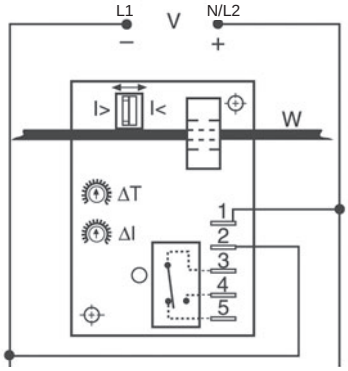
N = Relay contacts are non-isolated.
NO = Normally Open
NC = Normally Closed
C = Common
T1 = Undervoltage Trip Point
T2 = Restart Delay

**FIGURE 16 - KVM Series**




V = Voltage
L = LED
S = Undervoltage Setpoint
NO = Normally Open
NC = Normally Closed
C = Common, Transfer Contact

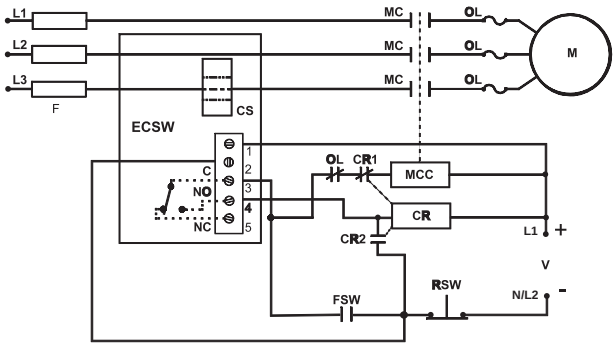
**FIGURE 17 - ECS Series**




V = Voltage
I> = Overcurrent
I< = Undercurrent

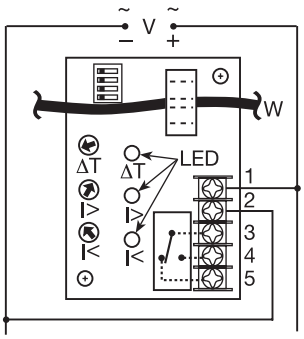
W = Insulated Wire
Carrying Monitored Current
Relay contacts are isolated.

**FIGURE 18 - ECSW Series**



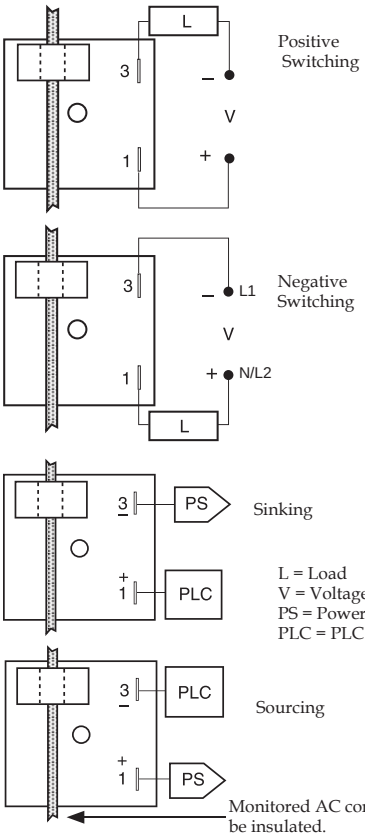

MC = Motor Contactor
M = Motor
F = Fuses
OL = Overload
RSW = Reset Switch

FSW = Fan or Float Contacts
CR = Control Relay
CS = Current Sensor
MCC = Motor Contactor Coil



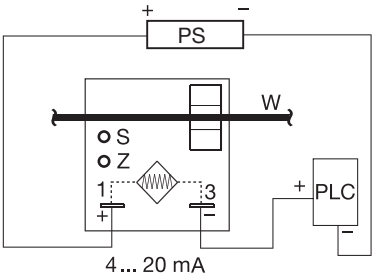

V = Voltage
I> = Adjustable Overcurrent
I< = Adjustable Undercurrent
W = Monitored Wire
ΔT - Adjustable Trip Delay

**FIGURE 19 - TCS Series**



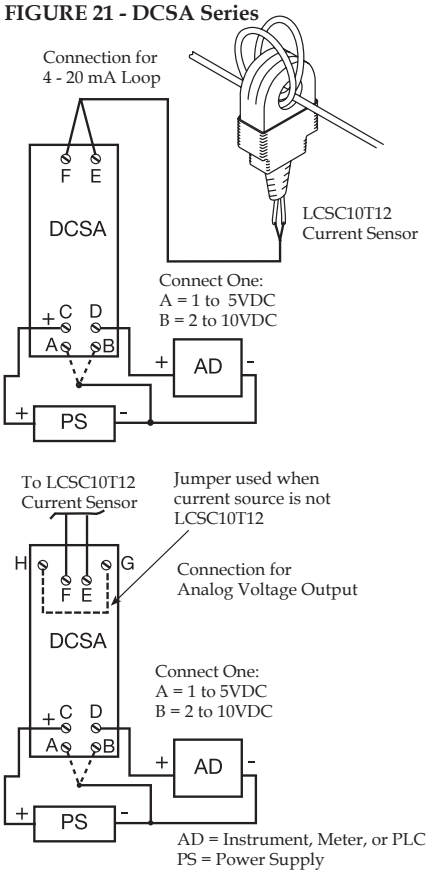

L = Load
V = Voltage
PS = Power Supply
PLC = PLC Digital Input Module

**FIGURE 20 - TCSA Series**




PS = Power Supply
Z = Zero Adjust
S = Span Adjust
W = Insulated Wire Carrying Monitored Current
PLC = PLC Analog Input or Meter Input

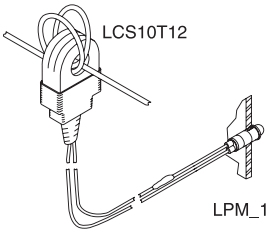
**FIGURE 21 - DCSA Series**




AD = Instrument, Meter, or PLC Input
PS = Power Supply

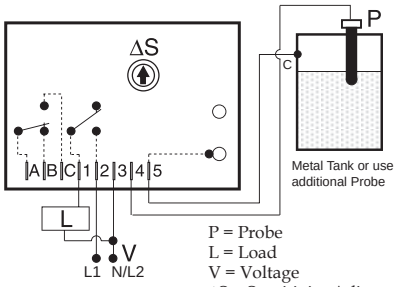
# Appendix C - Connection Diagrams

**FIGURE 22 - LCS10T12**



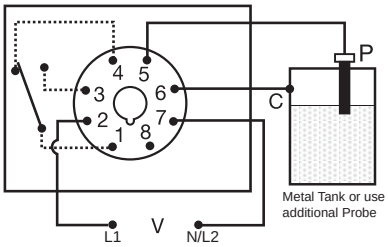

Wire Length: 500 ft. (152.4m) max. (Customer Supplied)
CAUTION: The LCS10T12 must be connected to the LPM12 or LPMG12 before current flows to prevent damage or shock hazard. Monitored wires must be properly insulated.

**FIGURE 23 - LLC1 Series**



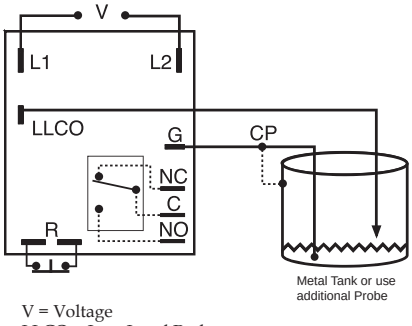

P = Probe
L = Load
V = Voltage
ΔS = Sensitivity Adjustment
Connect common to conductive tank or an additional probe as required.
Contacts A, B & C are isolated.

**FIGURE 24 - LLC4 Series**



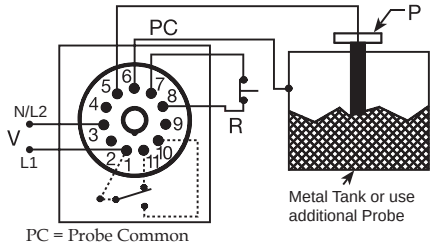

P = Probe
C = Probe Common
V = Voltage
Relay contacts are isolated.
Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

**FIGURE 25 - LLC8 Series**



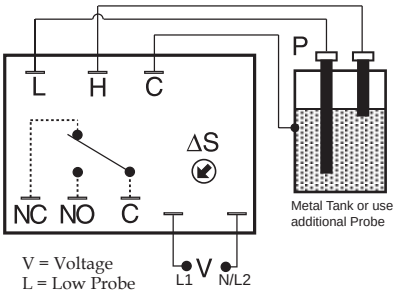

V = Voltage
LLCO = Low Level Probe
G or CP = Ground or Common (Reference) Probe
R = Optional NC Reset Switch (not included)
NO = Normally Open
NC = Normally Closed
C = Common or Transfer Contact
Relay contacts are isolated.
Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

**FIGURE 26 - LLC6 Series**



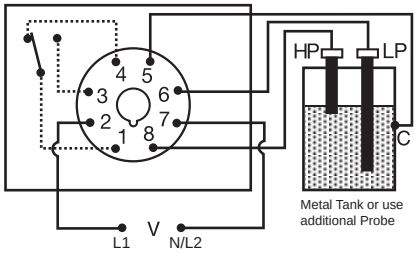

PC = Probe Common
P = Probe
V = Voltage
R = Optional NC Reset Switch
Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

**FIGURE 27 - LLC2 Series**



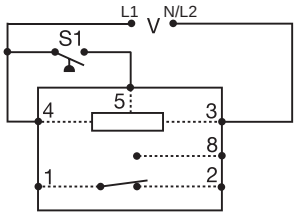

V = Voltage
L = Low Probe
H = High Probe
C = Probe Common
ΔS = Sensitivity Adjustment
NC = Normally Closed
NO = Normally Open
Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

**FIGURE 28 - LLC5 Series**

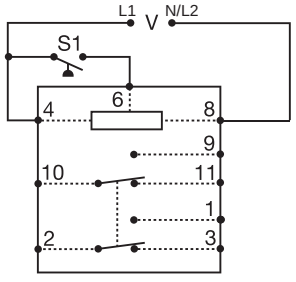



HP = High Level Probe
LP = Low Level Probe
C = Probe Common
V = Voltage
Relay contacts are isolated.
Connect common to conductive tank. Additional probe is necessary for non-conductive or insulated tanks.

**FIGURE 29 - ARP Series**

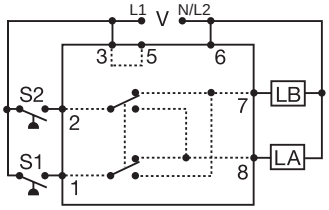



SPDT 8-pin




DPDT 11-pin

Relay contacts in above are isolated.



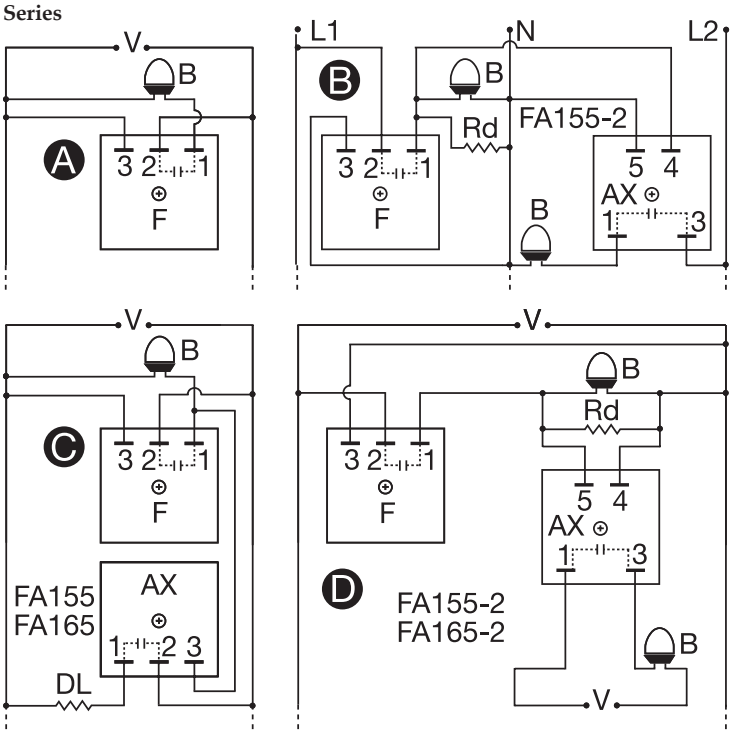

DPDT 8-pin cross wired

V = Voltage
LA = Load A
LB = Load B
S1 = Primary Control Switch
S2 = Lag Load Switch

Duplexing (Cross Wired): Duplexing models operate the same as alternating relays and when both the Control (S1) and Lag Load (S2) Switches are closed, Load A and Load B energize simultaneously.

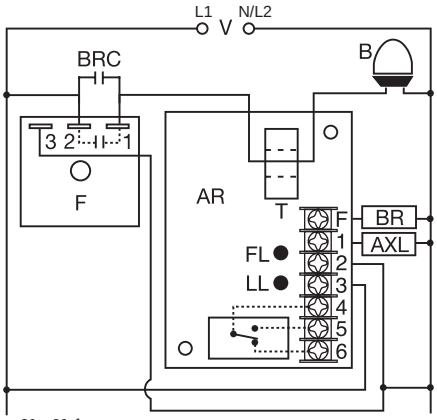
The DPDT 8-pin, cross wired option, allows extra system load capacity through simultaneous operation of both motors when needed. Relay contacts are not isolated.

**FIGURE 30 - FS155 & FS165 & FA Series**



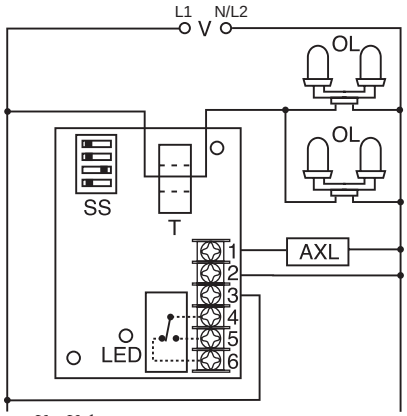

F = Flasher (FS155-30T, FS155-30RF, FS165-30T, FS165-30RF)
AX = Auxiliary Unit
B = Beacon
DL = Dummy Load for Constant Line Loading
Rd = 3.3 KΩ @ 5W for 120VAC
8.5 KΩ @ 5W for 230VAC

**FIGURE 31 - FB Series**




V = Voltage
B = Beacon
F = Flasher
BRC = Flasher Bypass Relay Contacts
T = Toroid
AR = FB Alarm Relay
BR = Bypass Relay Coil
FL = Flasher Failure LED
LL = Lamp Failure LED
AXL = Lamp Alarm Relay Coil
NOTE: Flasher module may be located on either the line or load side of the toroidal sensor.

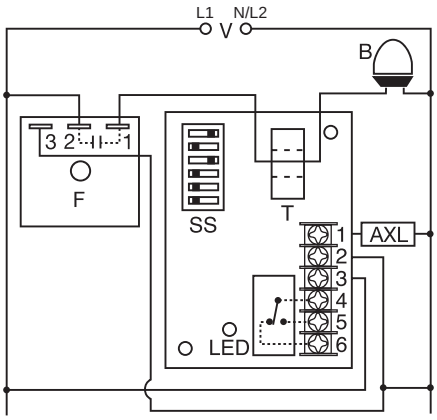
**FIGURE 32 - SCR490D**



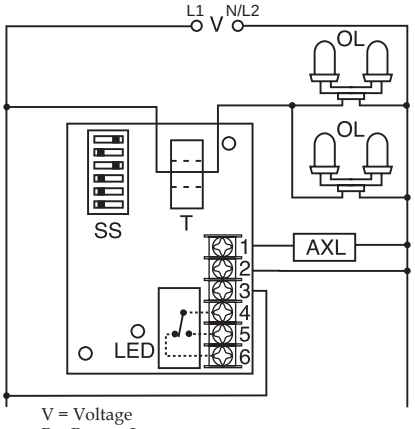

V = Voltage
OL = Obstruction Lamps
T = Toroid
SS = Selector Switch
AXL = Auxiliary Load/Alarm
Relay contacts are isolated.

**FIGURE 33 - SCR Series**

Beacon Connection Diagram



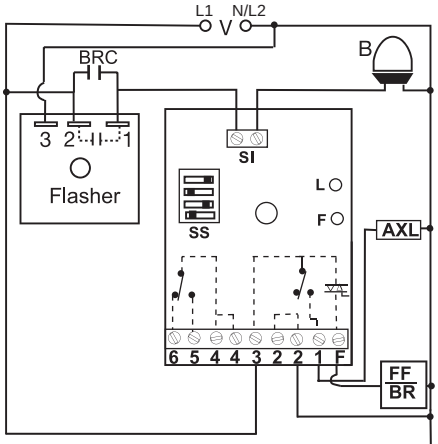

Obstruction Lamp Connection Diagram




V = Voltage
B = Beacon Lamps
SS = Selector Switch
T = Toroid
F = Flasher
AXL = Auxiliary Load/Alarm
OL = Obstruction Lamps
Relay contacts are isolated.

# Appendix C - Connection Diagrams

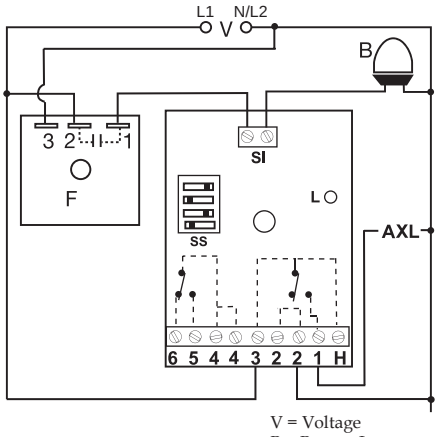
**FIGURE 34 - FB9L**



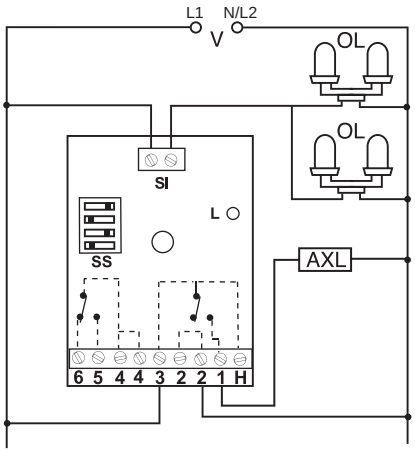

V = Voltage
B = LED Beacon
SS = Selector Switch
SI = Sensor Input
L = Indicator
F = Flasher Failure LED
AXL = Auxiliary Load/Alarm
FF = Flasher Failure/Bypass Relay
BRC = Bypass Relay Contacts

**FIGURE 35 - SCR9L**

Beacon Connection Diagram

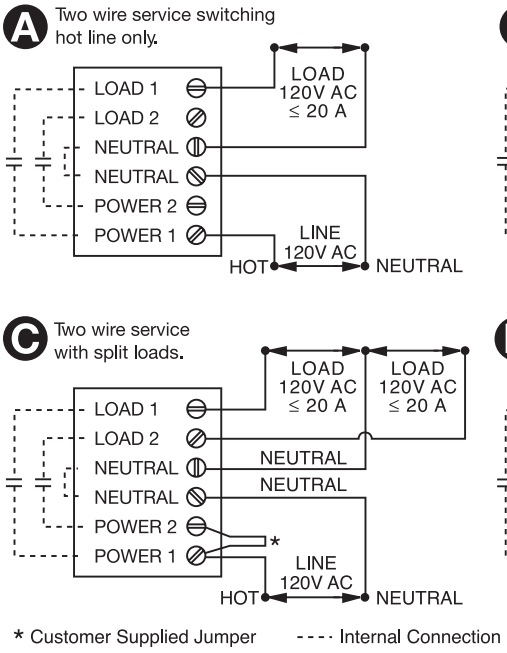



Obstruction Lamp Connection Diagram



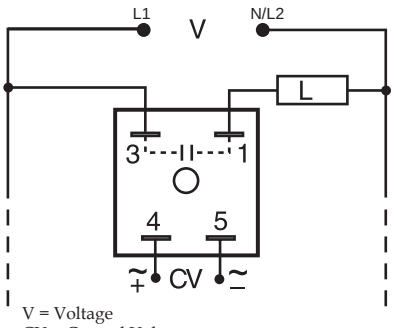

V = Voltage
B = Beacon Lamps
SS = Selector Switch
L = LED Indicator
F = Flasher
AXL = Auxiliary Load/Alarm
OL = Obstruction Lamps
SI = Sensor Input
H = "3" Spare AC Hot Connection (2A max.)

**FIGURE 36 - PCR Series**




* Customer Supplied Jumper ---- Internal Connection

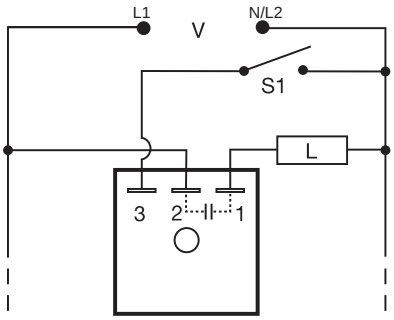
**FIGURE 37 - SIR1/SIR2 Series**




V = Voltage
CV = Control Voltage
R = Reset
NC = Normally Closed Output
NO = Normally Open Output
= Undefined time

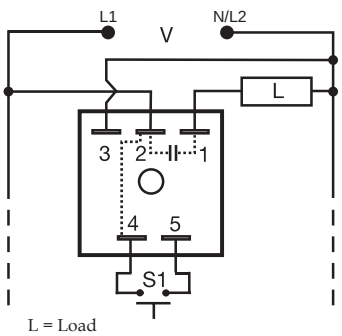
Load may be connected to terminal 3 or 1.
Note: Normally open output is shown. Normally closed output is also available.

**FIGURE 38- SLR Series**



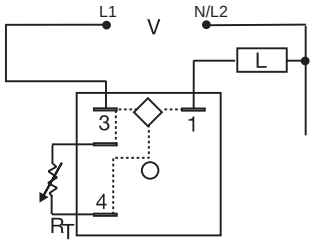

L = Load
S1 = Initiate Switch
Note: Normally open output is shown. Normally closed output is also available.

**FIGURE 39 - NLF1/NLF2 Series**




L = Load
S1 = Control Switch
Internal connections between terminals 2 & 4.

**FIGURE 40 - PHS Series**




Triac Output Device
V = Voltage
L = Load
$R_T$ = External Adjustment