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*MODEL STAR 10000*

# CIRCUIT BREAKER SLOW TRIP ALARM RELAY


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BCI Bulletin BCI-STAR10000- Revision 31 July 2008

 

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# STAR 10000 DESCRIPTION OF OPERATION

The vast majority of circuit breaker failures are caused by improper operation of the breaker operating mechanism. Proper operation timing and contact velocity remains the leading indicators for identifying potential circuit breaker problems. Unfortunately, many timing problems are missed using present routine maintenance methods. These methods involve clearing the breaker for a maintenance crew to inspect and maintain the operating mechanism. The process of clearing the circuit breaker exercises the mechanism and in many cases temporarily speeds up the operating time camouflaging problems that exist under actual loading conditions. In these cases, the only way to detect real operation timing is with "ON LINE MONITORING". Actual conditions exist when a circuit breaker is on line and has had months or even years remaining in the closed position. After this extended period in one position, the timing of that "first operation" is the true indicator for maintenance requirements.

The **STAR 10000** (**S**low **T**ime **A**larm **R**elay) is a very accurate on-line timer for substation equipment. The **STAR 10000** will time from 0 to 9999 milliseconds in 1 millisecond increments. The last 8 operating times are stored in non-volatile memory and are easily displayed by pressing the menu pushbutton. The Star 10000 can be used for trip or close (AC or DC) operation timing. For trip timing applications, timing begins at trip initiation and ends at trip (b seal closing or green light on) completion. There is an adjustable quiet-down period after each timing operation. This allows the timer to ignore high speed reclosing operations. If the time before inhibit (i.e. green light on) is beyond the trip time setting, the timer will pick up an on board auxiliary dual contact interposing relay. There are two isolated dry contacts (normally open) for alarm and SCADA uses. The alarm contacts have user settable delays and alarm pulse widths which provide multiple user alarm options. Other uses for the STAR10000 include timing regulator steps, breaker synchronization, relay testing, etc. Power requirements are 48-140VDC. The timer will start timing upon sensing the trip signal voltage and stop timing when voltage to the timer stop (inhibit input terminals) is applied. The start & stop (inhibit) voltages required are 48-140 V AC or DC.

**Typical Trip Timing Installation & Operation**

1. Mount the STAR 10000 in the circuit breaker control cabinet or at the switchboard.
2. Connect the power, trip wire, closed auxiliary contact and annunciation/SCADA terminations.
3. Determine the trip time by operating the breaker and reading the STAR10000 display.
4. Set the TIME SET for a period exceeding the actual trip time.
5. Set the RELAY DELAY period. (Alarm Delay)
6. Set the RELAY PULSE period. (Alarm Relay Closed Time Period)
   - If latched is selected the Star will not time subsequent operations until manual reset.
7. Set the QUIET DOWN period. (Ignore Subsequent Alarms)

Timing starts when positive voltage is applied to the (Trip +) #1 terminal of TB1 and stops when inhibit terminals # 7&8 of TB1 receive a voltage > 48V AC or DC.

Set the Star 10000 for a few milliseconds beyond the factory specified trip time.
**Example:** **Breaker should trip in 24 milliseconds.**
**Set the Star 10000 for 28 milliseconds.** If the breaker fails to trip within 28 milliseconds, the **Star 10000** alarms indicating a slow trip has occurred. Any slowdown of the operating mechanism or average velocity during the trip cycle is cause for concern and an inspection is warranted.

# DISPLAY INFORMATION

**1 . Trip Alarm Time -** The TIME displays provide the last 8 trip time values. They are denoted by a TIME number 1 through 8 where TIME #1 is the most recent and TIME #8 is the oldest trip time.

 

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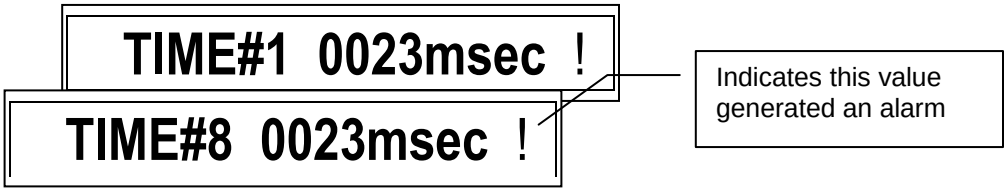


A trip time is defined as the period between the assertion of the TRIP input and the INHIBIT input. If a trip time is measured to be greater than the TIME SET value it will generate an alarm. When these periods are saved in the buffer they are marked as having generated an alarm with an exclamation point at the far right side of the display.

Note- The maximum measurable TIME period is 9,999 milliseconds.

2. **Alarm Threshold Preset -** Trips times greater than the TIME Set will assert the alarm condition. Values from 1 to 9,999 milliseconds are allowed.


3. **Output Relay Alarm Delay -** period of time before alarm relay is activated. Values between 0 and 500 seconds are allowed.


4. **Output Relay Alarm Pulse -** period of time that the alarm relay will be activated. Values between 1 to 100 seconds and latched are allowed.


5. **Alarm Quiet-Down Period -** period of time after a trip event has occurred before a new event will be accepted. This parameter setting is used to ignore high speed reclosing operations. Values between 5 and 10 seconds are allowed.


## DISPLAY CONTROL

The operator uses the front panel switches to select display information and to preset parameters.

There are three front panel switches labeled **MENU,** $\sigma$**,** (up arrow) and $\tau$ (down arrow).

 

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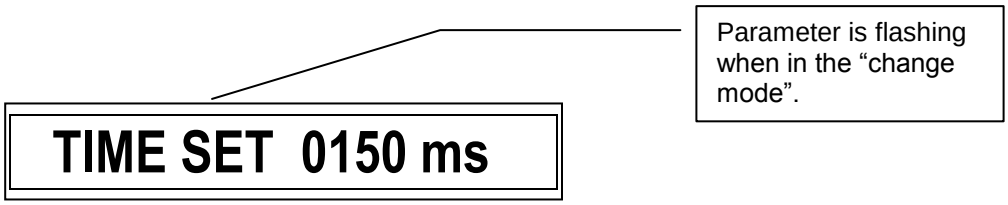
**Display Selection -** push the **MENU** switch will cause the display to scroll through the different parameters available.

**Parameter Changes -** when the operator wishes to modify a parameter (such as TIME SET) the following procedure is followed.

Press the **MENU** switch until the parameter to be changed is in view. The operator then pushes and holds the **MENU** switch for 1 to 2 seconds until the display enters the "update" mode. The operator knows this mode is active because the display parameter will be flashing.




Pressing the arrow switches at this time will cause the parameter value to change. Once the new value has been selected, the **MENU** switch is again pushed and released. This loads the new value and takes the display out of the update mode (display is no longer flashing). By forcing the operator to place the display in the "update" mode accidental changes are prevented.

Alarm **Reset -** When the alarm condition is latching it can only be cleared from the front panel. This is performed by pressing the two arrow "$\sigma\tau$" switches simultaneously and immediately releasing. Once cleared, the TIME #1 display will stop flashing and the ALARM relay will reset.

TIME **Reset-** A secondary reset is performed by pressing the two arrow switches simultaneously and holding for 3 to 5 seconds. This action causes any alarms to be deactivated and the TIME #1 through 8 buffers to be cleared to zero.

**Non-volatile Memory -** The unit contains non-volatile memory that is used to save preset parameters in case of power failure. All preset parameters are automatically loaded when power is restored to the unit. The preset parameters restored are TIME Set, Reference time, Relay Delay, Relay Pulse, Quiet Down and last 8 recorded times.

**Auto Display -** The unit will automatically select the TIME#1 display 20 seconds after the last switch operation.

**Reference Time** – The reference time can be set using the up and down keys. This is a storage area for operator convenience and provides no other function other than a reference time.

To set the reference time –
1. Press menu until the ref time is displayed.
2. Press and hold the menu button until the display is flashing.
3. Using the up and down arrows, adjust for the desired time. –or-
4. Press both up and down arrows at the same time to load the present time #1 into the ref time storage area.

**Data Storage Mode** – When the data storage mode is in the “SHIFT” mode, each time a new event occurs the value of time #7 is moved to time #8, #6 to #7, #5 to #6, ….#1 to #2. The previous value of #8 is lost.

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When in the “HOLD” mode and the value of time #8 is zero, each time a new event occurs the operation is the same as in the shift mode.

When in the “HOLD” mode and the value of time #8 is not zero, each time a new event occurs no data is moved and the previous value of time #1 is lost. This preserves the oldest 7 trip times and the most recent trip time.

 

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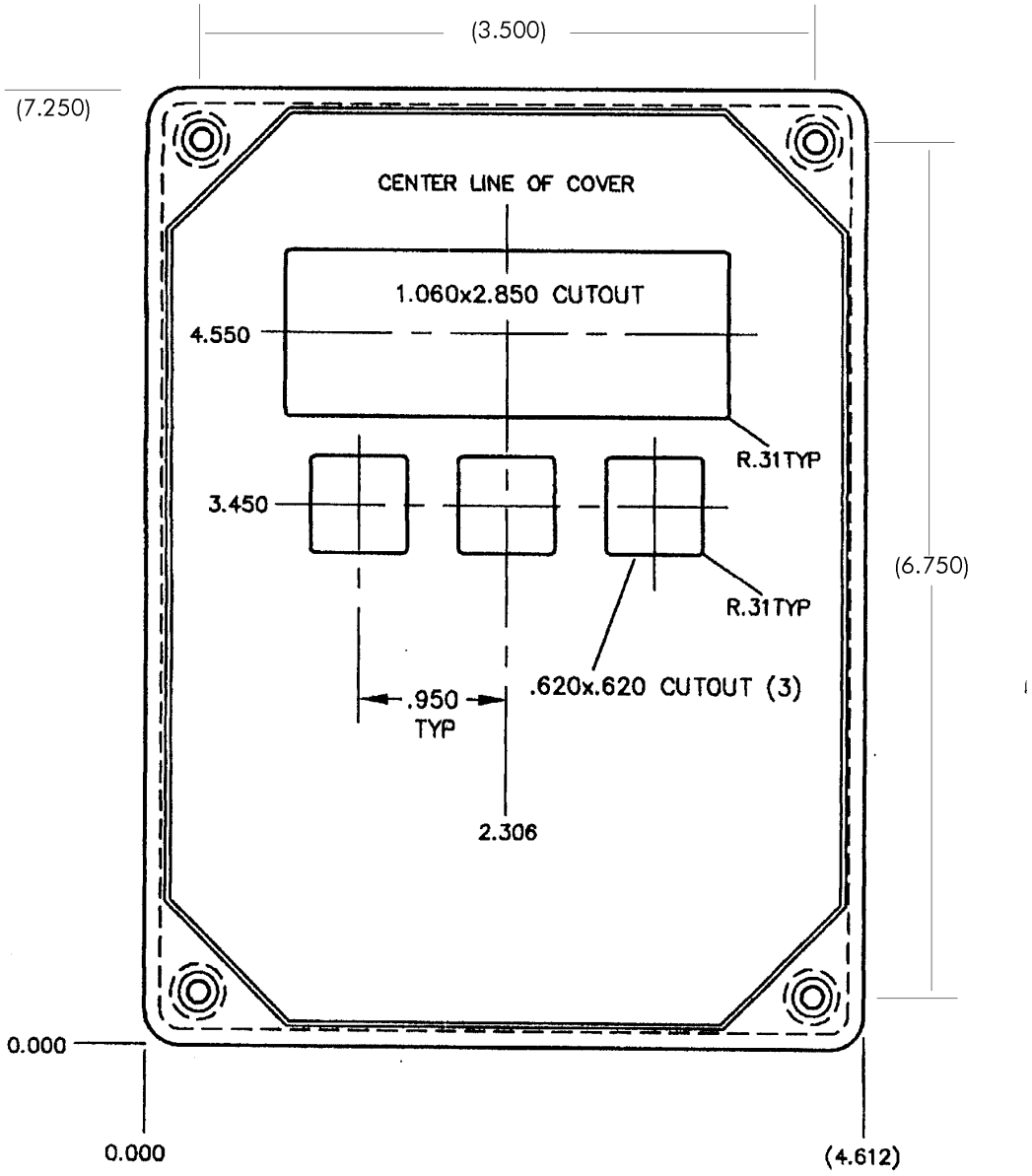


NOTE EXCEPT AS SHOWN: TOLERANCE: .XXX=±.010

| BARRINGTON CONSULTANTS, INC | | | DRAWN B JOHNSON<br>REV DATE 2-16-98 | |
|---|---|---|---|---|
| TITLE<br>PLASTIC COVER MODIFICATION | FILE:<br>BARR-117 | DATE 10-7-97<br>SCALE FULL | DRAWING NO.<br>BARR-117 | REV<br>A |

 

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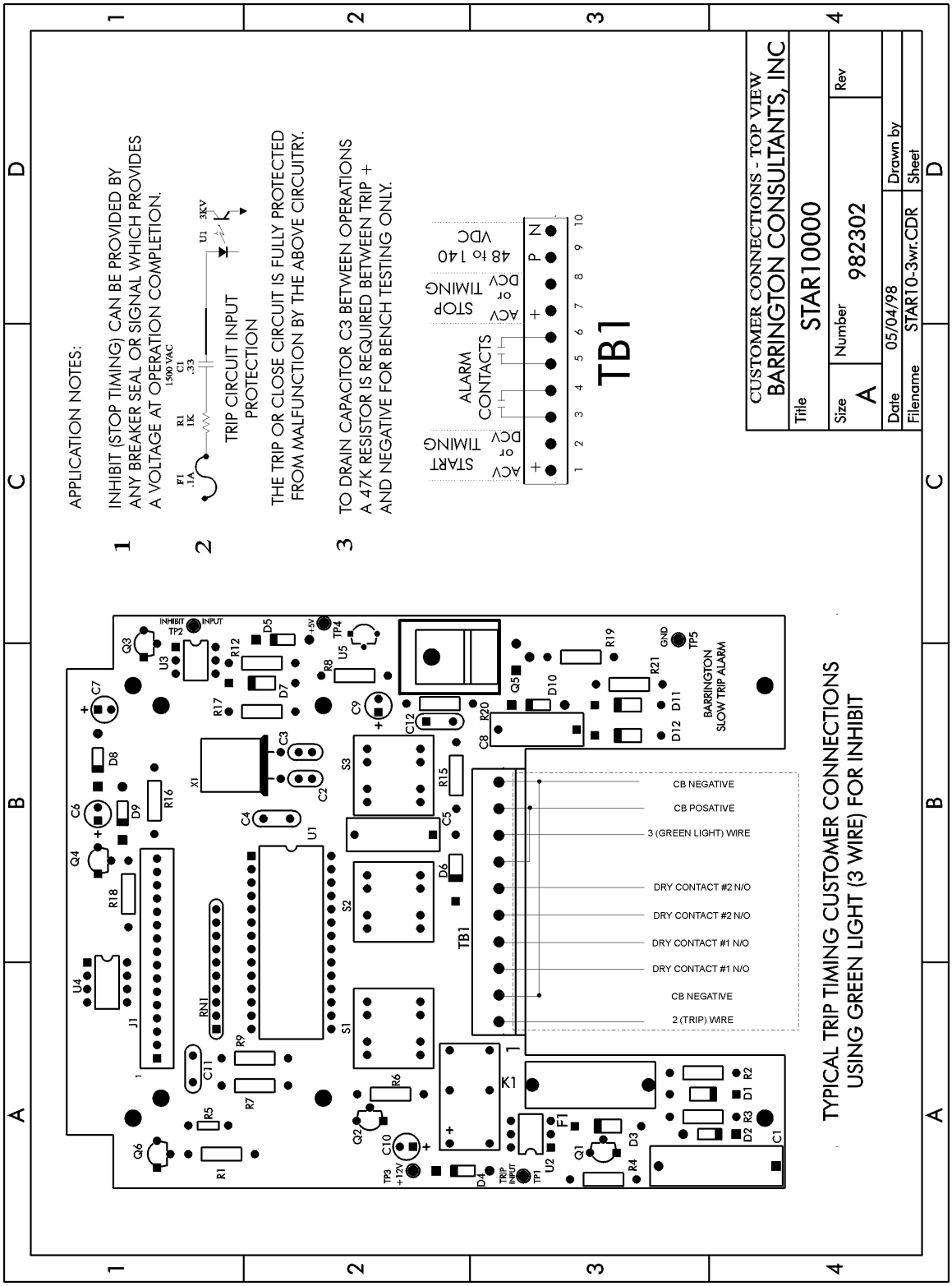


 

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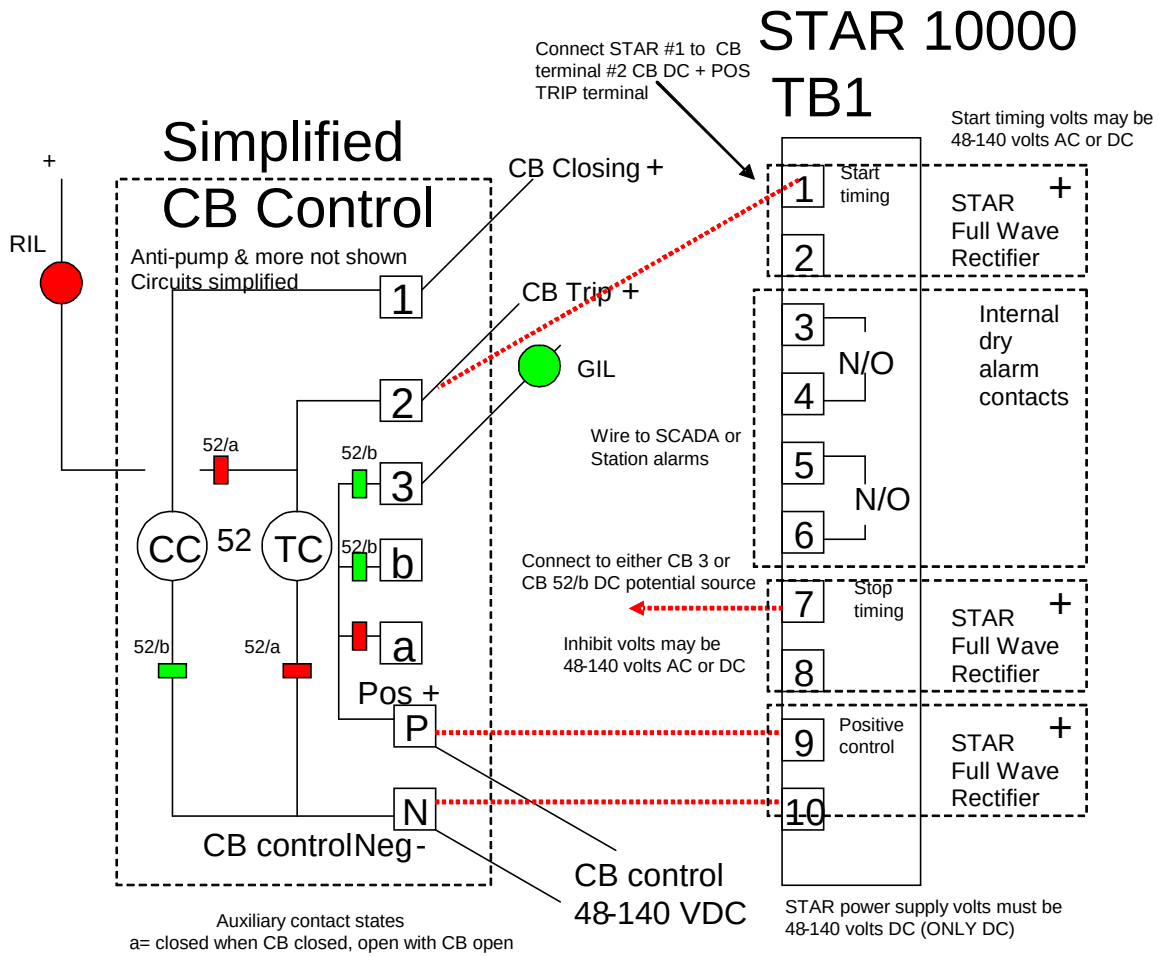
# STAR 10000 FUNCTIONAL EXAMPLE

## For TimingTrippingof CB With DC Trip

**REVISED 4-19-00**

*STAR 10000 may be used For timing CB trip or close*




Auxiliary contact states
a= closed when CB closed, open with CB open
b= closed when CB opened, open with CB closed
Control shows generic CB with DC control volts.
Please note differences for AC close and DC trip.

**CAUTION**
**CB terminals are provided only as functional examples, CB terminal numbers are NOT intended for actual wiring reference!**

Connect STAR 9 & 10 to CB DC power source -

For DC trip timing, jumper STAR-10 and STAR 2 to Star 8 (if CB 3 GIL is DC); Connect CB 2 (DC+) to STAR 1; and connect CB 3 GIL or CB 52/b DC terminal "b" to STAR 7.

**STAR internal full wave rectifiers prevent or correct polarity errors by end** users. All STAR inputs are optically isolated from all other inputs allowing AC close with DC trip.

**Questions? E-mail jea@barringtoninc.com**

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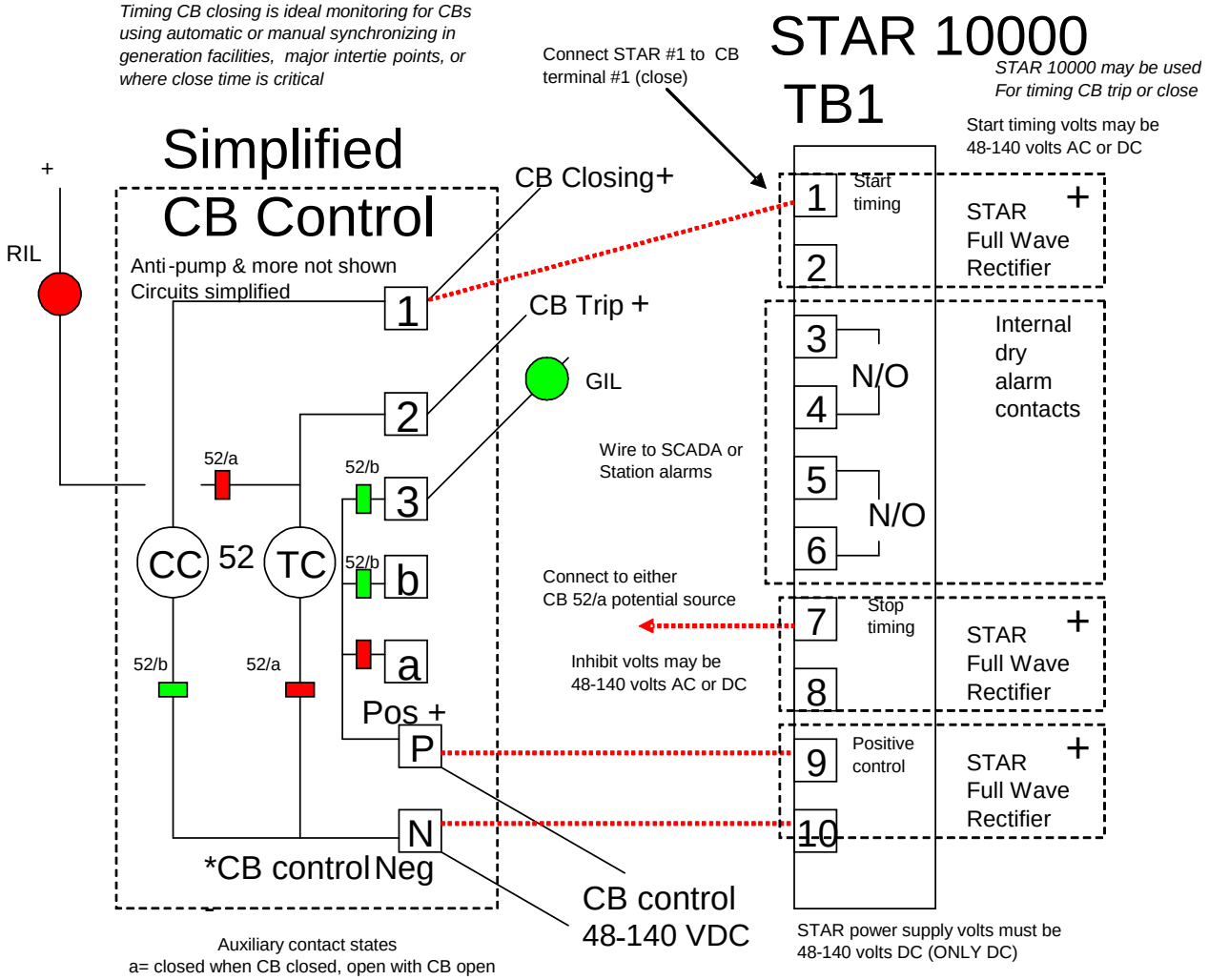
# STAR 10000 FUNCTIONAL EXAMPLE

## For Timing Closing of CB With DC Close & DC Trip

**REVISED 4-19-00**

*Timing CB closing is ideal monitoring for CBs using automatic or manual synchronizing in generation facilities, major intertie points, or where close time is critical*




Auxiliary contact states
a= closed when CB closed, open with CB open
b= closed when CB opened, open with CB closed
Control shows generic CB with DC control volts.
Please note differences for AC close and DC trip.

**CAUTION: CB sketch for DC trip & close ONLY.**

**CB terminals are provided only as functional examples, CB terminal numbers are NOT intended for actual wiring reference!**

Connect 9 & 10 to CB power source 48-140VDC + &- respectively.

For DC same voltage close & trip, jumper STAR terminals 2&8-10.

For AC close and DC trip, jumper STAR 8-10 and connect STAR 2 to OP (neutral) of the AC closing voltage.

For AC close and AC trip, jumper STAR 2-8 to AC OP of same volts as close/open AC control and connect STAR 9 & 10 to a DC + and- source, respectively.

STAR internal full wave rectifiers prevent or correct polarity errors by end users. All STAR inputs are optically isolated from all other STAR inputs, allowing AC close with DC trip.

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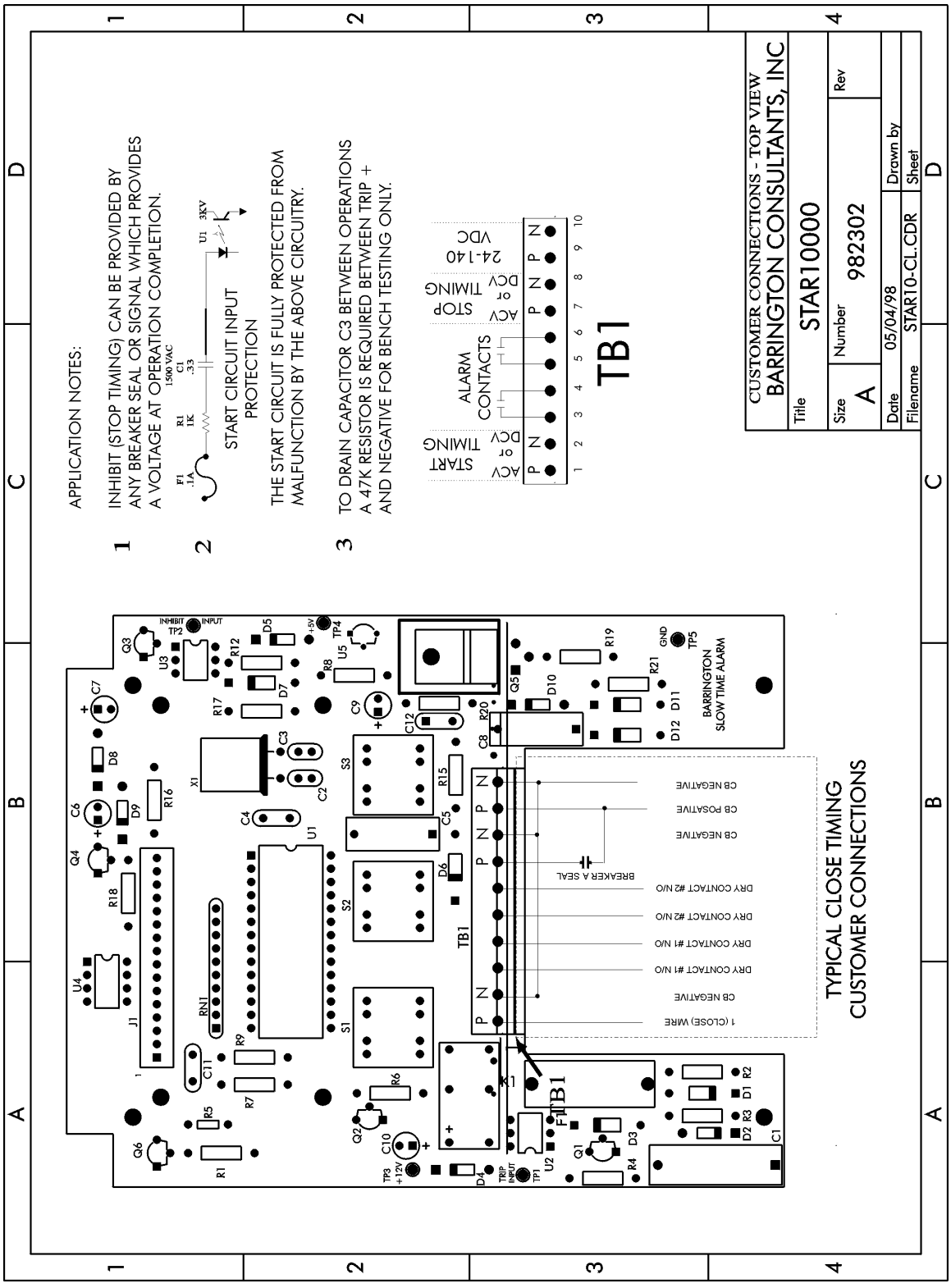


 

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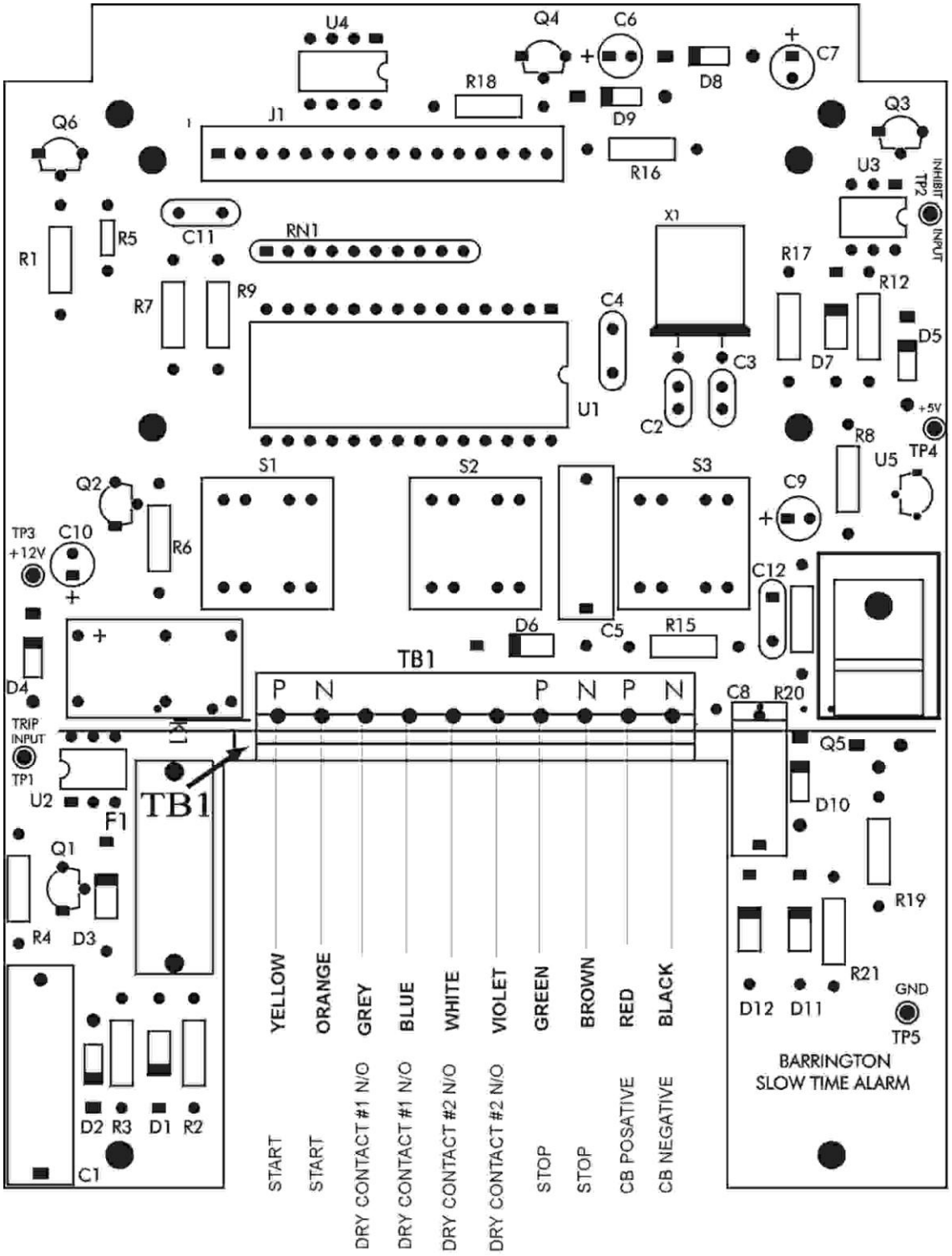


FACTORY COLOR CODE

USER CONNECTIONS

STAR 10000 TERMINALS

STAR 10000 INTERNALS

 