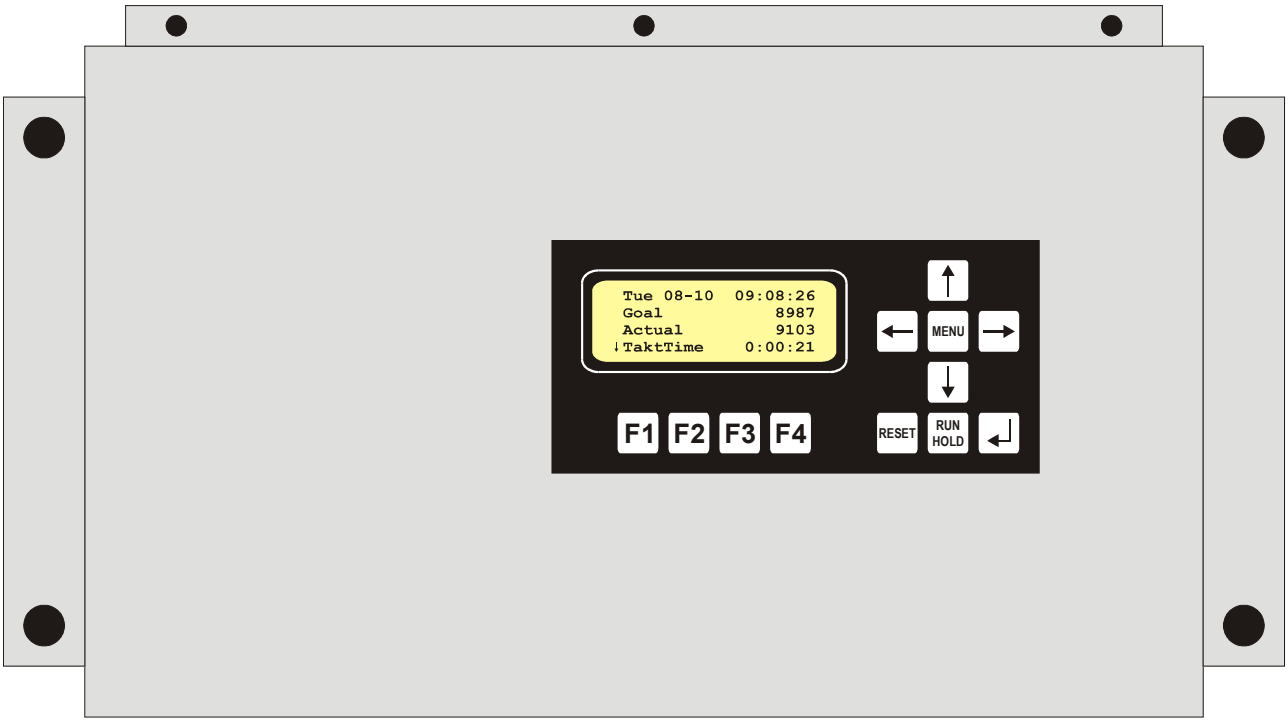
American LED-gible®

Reducing Downtime Across the Nation!

The PPT Control Box
Model AF-2450-057

Owners Manual

PPT Control Box with LCD, AB-1194-600 / PP-2110-395J



American LED-gible® Inc.
1776 Lone Eagle St.
Columbus, OH 43228
(614) 851-1100 Phone
(614) 851-1121 Fax
www.ledgible.com www
ledgible@ledgible.com e-mail

Manual PB-2149-441
Revision G
April 12, 2007

Table of Contents

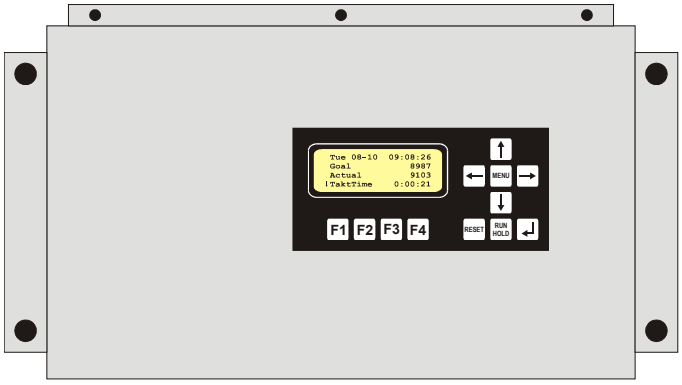
1.0 Getting Started

Thank you for your purchase of an AMERICAN LED-gible® product. We take pride in the equipment we build, and we appreciate your support. We will do everything we can to keep you happy with your purchase for many years to come. Please review this manual carefully, and if you have any questions, call, e-mail, or fax us and we will be glad to help you. American LED-gible support can be reached at:

American LED-gible® Inc.
1776 Lone Eagle St.
Columbus, OH 43228
(614) 851-1100 Phone
(614) 851-1121 Fax
www.ledgible.com www
ledgible@ledgible.com e-mail

1.1 Product Description

The AF-2450-057 PPT control box is a special purpose "Production Pace Timer" designed to even out the rate of product assembly. By providing real time goal/actual feedback the PPT prevents both under and over production while simultaneously improving product consistency and quality.



The AF-2450-057 PPT control box is the brains of the PPT system. The control box houses a microprocessor board which computes the production goal count, and measures the production actual count in real time. The control box also measures production up and down time. Other production metrics such as deviation and efficiency are computed from the goal and actual counts in real time.

Production metrics are transmitted to a separately purchased display marquee, in real time. There are several different standard display marquees available for use with the PPT control box, however completely custom display marquees can be constructed to meet your specific requirements if none of the standard marquees fits your needs.

The PPT control box has a real time clock that can be used to automatically reset the PPT before the beginning of each shift, and also pause the goal counter during scheduled breaks. Shifts and breaks can be set to only activate on selected weekdays such as Monday through Thursday, or Monday, Wednesday, and Friday, allowing split scheduling. Up to eight shifts and up to thirty two breaks can be defined for each week. For example, 6:00AM to 3:00PM, Monday through Friday would consume one of the eight shift entries.

When the PPT control box is reset, typically by the real time clock at the start of a shift, the date, time, goal count, actual count, up time, and down time values are saved in the production history archive before the counts and times are reset to zero. The archive has room to store twenty one entries. The oldest entry is aged out to make room for the newest one. Production history can be viewed using the LCD display on the control box at any time.

A 1 Farad super-cap backs up the PPT control box processor's memory and real time clock. The Super-Cap allows the system to retain operational values and the time of day for five days without power. Unlike batteries, super-caps do not require special recharge circuitry and have an expected life span in excess of 10 years.

Each PPT control box requires a separately purchased display marquee. There are over five hundred thousand possible combinations of display height (2.3 or 4.0 inch tall), display width (4 or 6 digit wide), number of display lines (2, 3, 4, 5, 6, or 7 lines), display line color (red, yellow, or green), field selection (shift goal, goal, actual, scrap, deviation, remaining, efficiency, complete, up time, down time, takt timer, or time of day), and enclosure construction (nema-1 painted steel, nema-4 painted steel, or nema-4X stainless steel) that can be used with the PPT control box. Many of the possible combinations are standard, however most are custom and built to order. Some of the more common combinations are shown below. Your marquee may appear to be quite different, but is functionally similar.

The following fields are available for display on the marquee:

Marquee Display Field	*Field ID / Format*
Shift Goal Shift Goal is a fixed number set by the system operator, which indicates the total number of units production must complete this shift. The control box uses shift goal to compute percent complete and remaining field values. The control box also uses shift goal to determine when it is time to activate the done and pulsed done relay outputs.	61h – 6D (XXXXXX) 64h – 4D (XXXX)
Goal Goal is an automatic up counter, which indicates the number of units production should have completed to remain on schedule. At the beginning of the shift, goal is reset to zero. During the shift, goal counts at the operator programmed rate. The control box uses goal to compute percent efficiency and deviation field values. The control box also uses goal to decide when to activate the green and red relay outputs.	41h – 6D (XXXXXX) 49h – 4D (XXXX)
Actual Actual is a counter, which indicates the number of units production has actually completed. At the beginning of the shift actual is reset to zero. During the shift the actual counter increments as completed units are sensed. The control box uses actual to compute percent efficiency, deviation, percent complete, and remaining field values. The control box also uses actual to decide when to activate the done, pulsed done, green, and red relay outputs.	42h – 6D (XXXXXX) 4Ah – 4D (XXXX)
Scrap Scrap is a counter, which indicates the number of defective units production has produced. At the beginning of the shift scrap is reset to zero. During the shift the scrap counter increments as defective units are sensed. The control box can optionally be configured to automatically decrement the actual counter whenever scrap counter is incremented.	6Eh – 6D (XXXXXX) 6Fh – 4D (XXXX)
Deviation / Difference Deviation shows the number of unit production is ahead of or behind schedule. Positive values indicate that production is ahead of schedule. Negative values indicate that production is behind schedule. Deviation is computed in real time using the equation: Deviation = Actual - Goal	43h – 6D (XXXXXX) 4Bh – 4D (XXXX)
Remaining Remaining shows the number of units production still needs to complete this shift. Positive values indicate that production is not yet done. Negative values indicate that production has produced too many units. Remaining is computed in real time using the equation: Remaining = Shift_Goal - Actual	62h – 6D (XXXXXX) 65h – 4D (XXXX)
% Efficiency % Efficiency shows the percent of goal, production is ahead of or behind schedule. Values greater than one hundred indicate that production is ahead of schedule. Values less than one hundred indicate that production is behind schedule. Efficiency is computed in real time using the equation: Efficiency = (Actual / Goal) * 100	44h – 6D (XXXX.XX) 4Ch – 4D (XXX.X)

Marquee Display Field	*Field ID / Format*
% Complete % Complete shows the percent of shift goal production has completed. Values greater than one hundred indicate that production has produced too many units. Values less than one hundred indicate that production must still complete more units. Complete is computed in real time using the equation: Complete = (Actual / Shift_Goal) * 100	63h – 6D (XXXX.XX) 66h – 4D (XXX.X)
Up Time Up time is a timer that measures the total amount of time production has worked so far this shift. Up time is reset to zero at the beginning of the shift, and times up throughout the shift. The up time timer is paused during breaks by the hold input, hold key, or automatic schedule. The up time timer is also paused during down events.	45h – 6D (HH:MM:SS) 53h – 6D (MMMMMM) 4Dh – 4D (HH:MM) 57h – 4D (MMMM)
Down Time Down time is a timer that measures the total amount of time production should have worked, but did not due to down events. The down time timer is reset to zero at the beginning of the shift and times up during down events. Activate the DOWN input to tell the PPT that a down condition exists. The down time timer is paused during breaks by the hold input, hold key, or automatic schedule.	46h – 6D (HH:MM:SS) 54h – 6D (MMMMMM) 4Eh – 4D (HH:MM) 4Fh – 4D (MM:SS) 58h – 4D (MMMM)
Takt Timer The Takt Timer times down from the system operator entered pace time to zero. When the takt time timer reaches zero, the goal counter is incremented and the takt timer resets itself the to programmed pace time, and times down again. The takt timer is paused during breaks by the hold input, hold key, or automatic schedule.	47h – 6D (HH:MM:SS) 55h – 6D (MMMMMM) 56h – 6D (SSSSSS) 50h – 4D (HH:MM) 51h – 4D (MM:SS) 59h – 4D (MMMM) 5Ah – 4D (SSSS)
Actual Takt Timer The Actual Takt Timer times down from the system operator entered pace time to zero. When the timer reaches zero, the display blinks, the over relay output turns on, and the pulsed over relay output turns on for two seconds. When the actual counter is incremented, the timer is reset to the programmed pace time, and times down again. The timer is paused during breaks by the hold input, hold key, or automatic schedule.	6Ah – 6D (HH:MM:SS) 6Bh – 4D (HH:MM) 6Ch – 4D (MM:SS)
Pace Time The pace time is the time interval between goal counter increments. The system operator enters this time into the control box during setup, and it does not change unless adjusted by the operator.	67h – 6D (HH:MM:SS) 68h – 4D (HH:MM) 69h – 4D (MM:SS)
Time of Day The control box time of day clock, in military format. (i.e. 1:00:00PM is displayed as 13:00:00)	48h – 6D (HH:MM:SS) 52h – 4D (HH:MM)
Date The current date from the control box real time clock.	6Dh – 6D (MM-DD)

1.2 Unpacking the PPT Control Box and Marquee

Every PPT system is carefully tested, both mechanically and electrically, before shipment. Inspect the units for damage, which may have occurred in transit. If there is evidence of damage or the system fails to operate, file a claim with the shipper and notify American LED-gible.® Save the shipping materials for inspection.

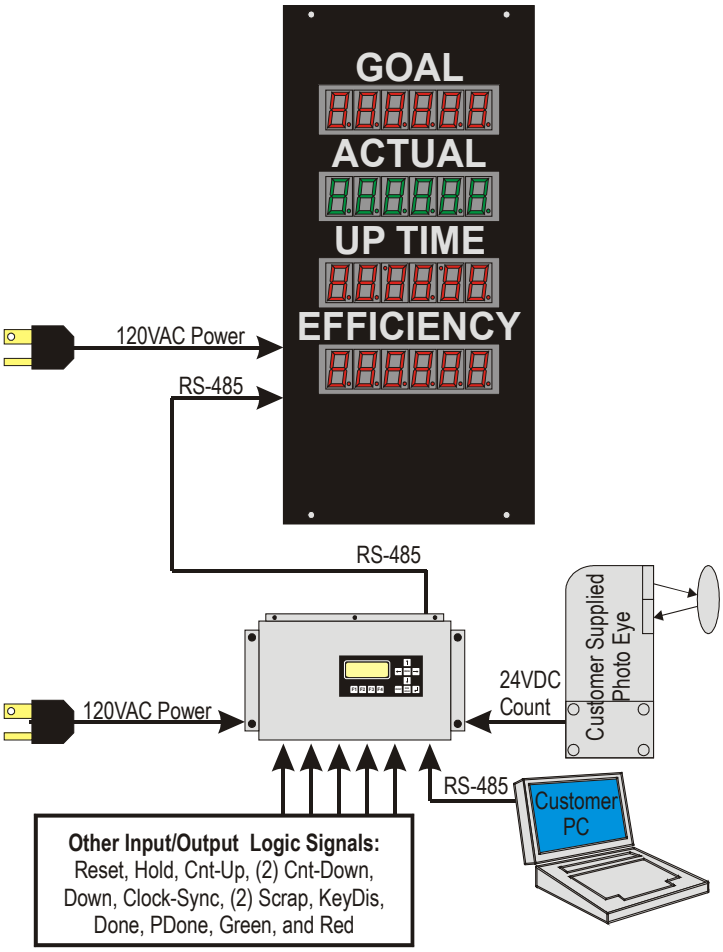
If there are no signs of shipping damage, carefully remove the PPT control box and marquee from the shipping skid. The control box is designed to be mounted to a wall using the wall mount tabs on the sides of the enclosure. Be sure to locate the control box such that the system operator can comfortably read the LCD display and operate the keypad. The marquee is designed to be hung from the ceiling or mounted to a wall. Be sure to locate the marquee where it is readily visible keeping in mind that the RS-485 communications cable must not exceed four thousand feet in total length. The next few sections of the manual will cover power and communications wiring. You may wish to review these manual sections before permanently mounting the equipment.

1.3 Overall System Wiring Diagram

After mounting the marquee and the PPT control box, system wiring must be completed. A general overall wiring diagram is shown to the right. This chapter will walk through installing system wiring starting from the marquee, and working towards the PPT control box.

Note: The photo eye, optional logic signals, and optional PC pictured below are supplied by the customer. The RS-485 communications cable must not exceed four thousand feet in length.

Note: The marquee pictured in the diagram on this page is meant to be representative of the many thousands of possible marquees used with the PPT control box. Your marquee may look quite different, however it is functionally similar to the diagram provided below and will require similar wiring.

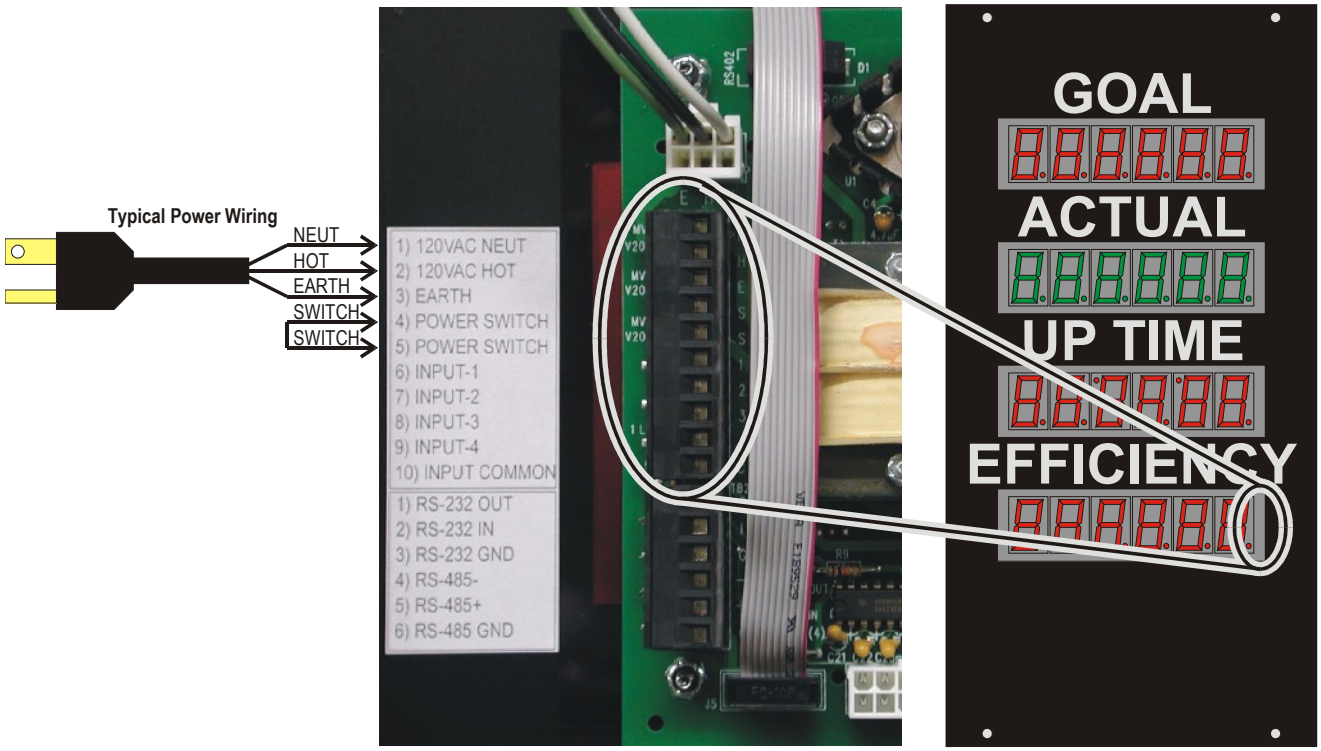


1.4 Installing Marquee 120VAC Power Wiring

Screw terminals for 120VAC power are provided within the marquee cabinet, typically on the bottom display circuit board, however in some custom build cases, ALI may provide DIN rail barriers or other screw terminals within the enclosure. 120VAC Power wires should be American Wire Gauge #16 with a 600 volt insulation rating. For maximum noise immunity, use separate conduit runs to bring power and communications wiring to the marquee.

Connect 120VAC Neutral to pin 1, 120 VAC Hot to pin 2, and Earth Ground to pin 3. A switch suitable for 120VAC power may be connected across pins 4 and 5 to control 120VAC power to the marquee. Otherwise pins 4 and 5 of the power connector must be jumpered or the marquee will fail to operate. Maximum power draw is 30W per display line.

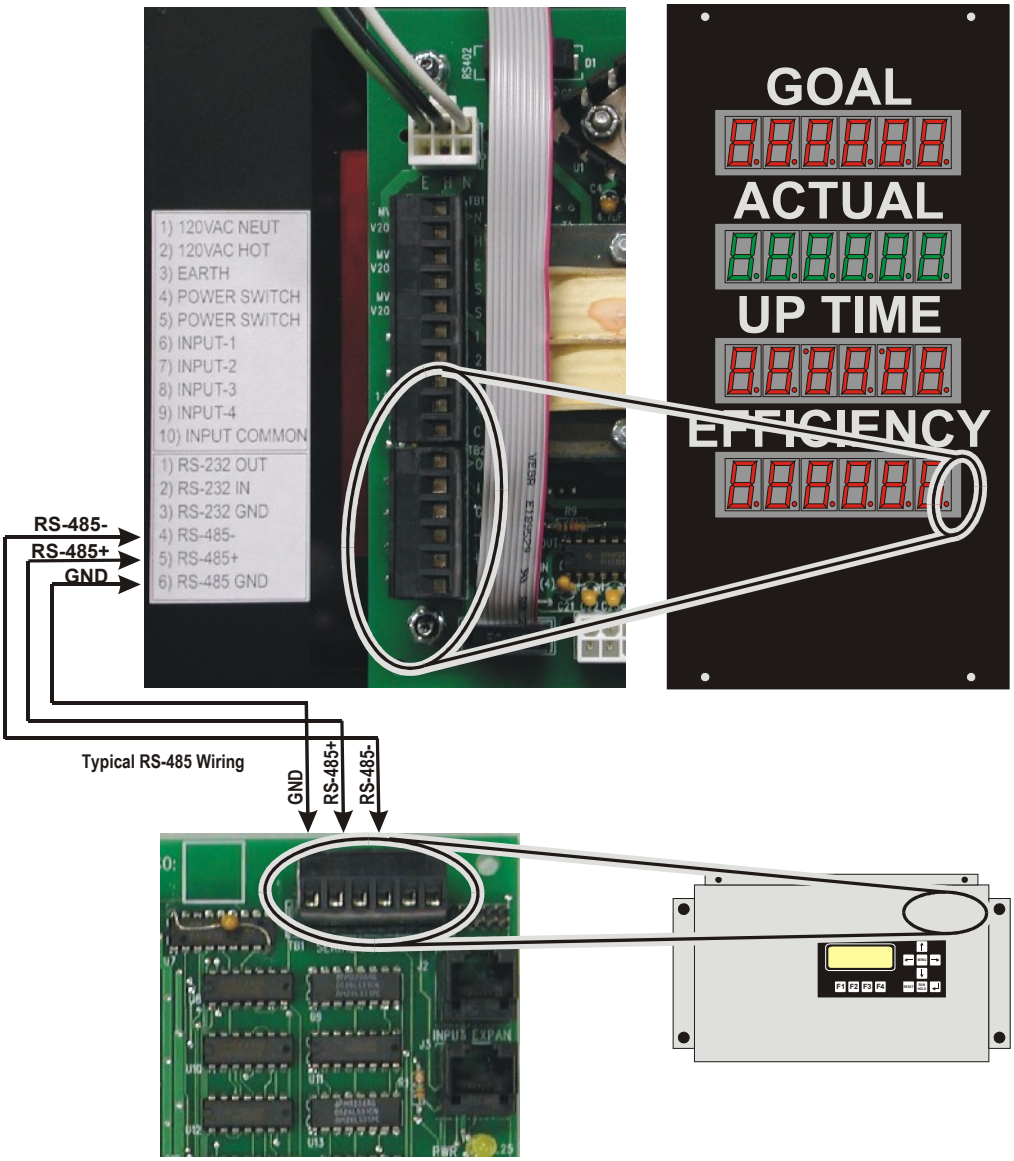
Note: The marquee pictured in the diagram on this page is meant to be representative of the many thousands of possible marquees used with the PPT control box. Your marquee may look quite different, however it is functionally similar to the diagram provided below and will require similar wiring.



1.5 Installing Marquee to Control Box RS-485 Wiring

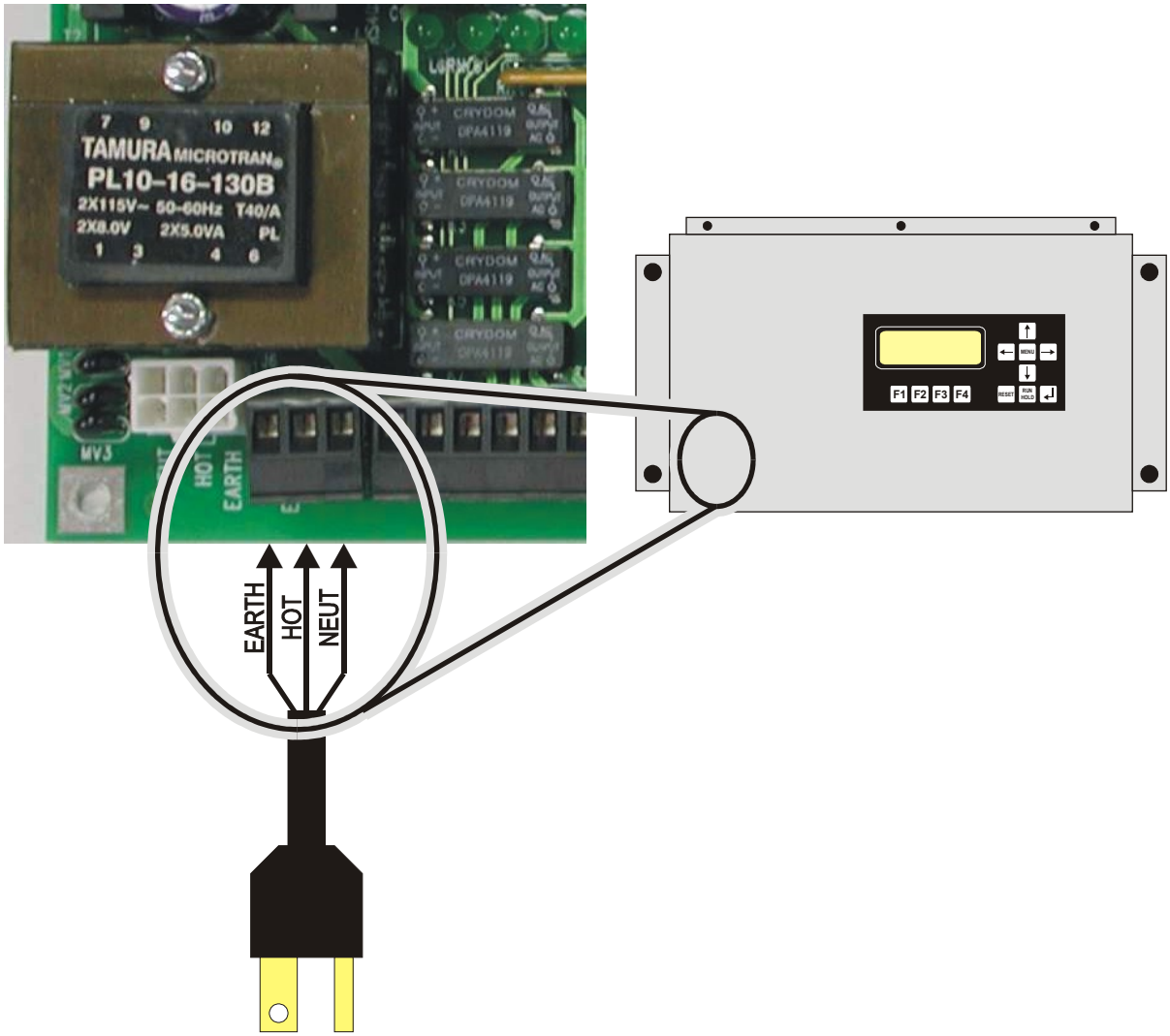
Screw terminals are provided within the marquee and the PPT control box for RS-485 communications, typically on the bottom display circuit board, however in some custom build cases, ALI may provide DIN rail barriers or other screw terminals within the enclosure.. The control box sends production data to the marquee over this cable at 19200 baud, no parity, eight data bits, one stop bit using ALI numeric command protocol. Interconnect the units as shown using a three conductor cable rated for data communications. ALI suggests using Belden 9463 “Blue-Hose” cable, but any cable designed for RS-485 communications should be acceptable. Note that this cable must not exceed four thousand feet in length.

Note: The marquee pictured in the diagram on this page is meant to be representative of the many thousands of possible marquees used with the PPT control box. Your marquee may look quite different, however it is functionally similar to the diagram provided below and will require similar wiring.



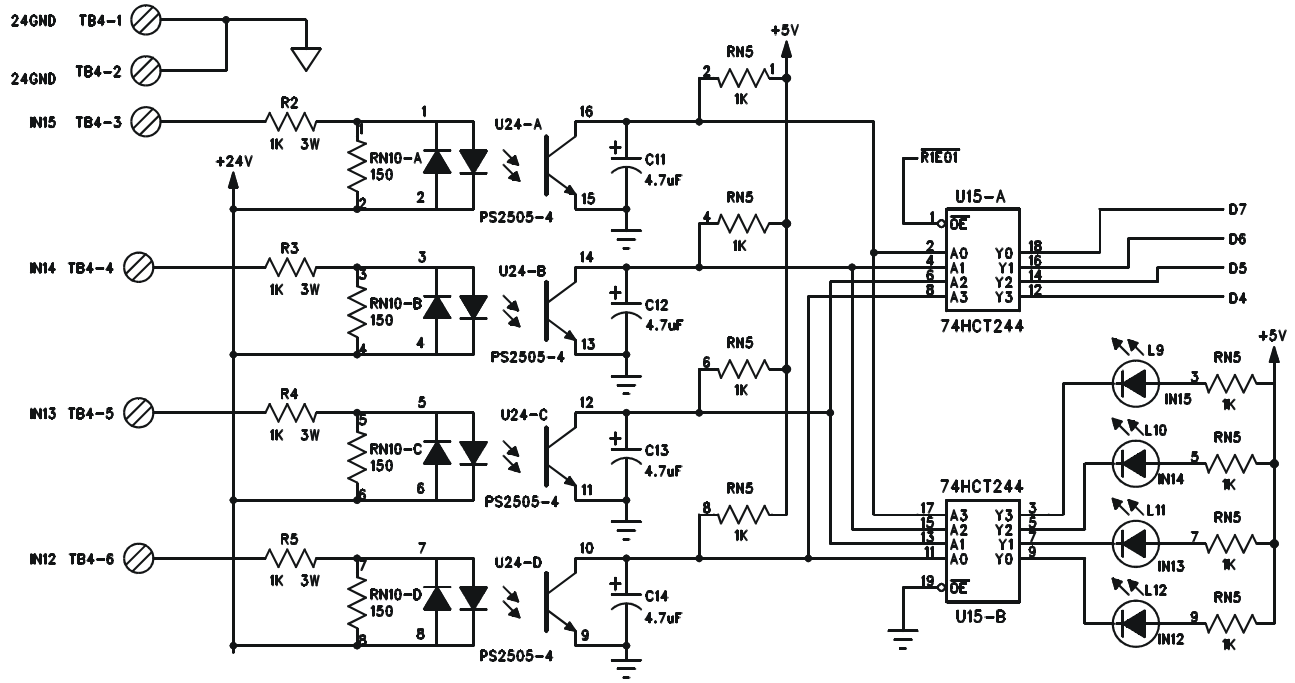
1.6 Installing PPT Control Box 120VAC Power Wiring

Screw terminals for 120VAC power are provided within the PPT control box. Connect 120VAC power to the control box screw terminals as shown below. 120VAC Power wires should be American Wire Gauge #16 with a 600 volt insulation rating. Maximum power draw is 20W.



1.7 PPT Control Box Logic Input Schematic

The control box includes an isolated 24VDC unregulated linear power supply to power the optically isolated logic inputs. The logic inputs are not sensitive to voltage, only the presence or absence of about 30mA of current flowing through the input. The inputs are designed to be activated by normally open relay contacts that connect the input terminals to 24GND. The inputs are also compatible with most NPN transistor outputs as well. (2N3904 Typical) A schematic showing (4) of the (16) logic inputs is provided below.



1.8 Installing PPT Control Box Input Logic Wiring

The PPT control box provides the following logic inputs:

HOLD – Pauses the takt timer, goal counter, and up/down timers during breaks. The real time clock can also be programmed to automatically hold the PPT during planned breaks by programming the shift schedule into the control box using the LCD/Keypad. The PPT can also be manually held by pressing the run/hold key on the keypad.

RESET – Resets the goal/actual/scrap counters and the up/down timers to zero. The real time clock can also be programmed to automatically reset the PPT at the beginning of each shift by programming the shift schedule into the control box using the LCD/Keypad. The PPT can also be reset by pressing the reset key on the keypad.

CLOCK – Pulsing this input makes the real time clock jump to the nearest whole hour. For example, if the real time clock reads 10:58:37 and the clock input is pulsed, it will jump ahead to 11:00:00. If the RTC reads 11:02:17 and the clock input is pulsed, it will jump back to 11:00:00. Pulsing this input once per day at an appropriate time, typically midnight, keeps the control box real time clock synchronized with the plant master clock. If the clock input is not used, the control box RTC will drift a couple seconds each week. However this can periodically be corrected by the system operator via the LCD/Keypad.

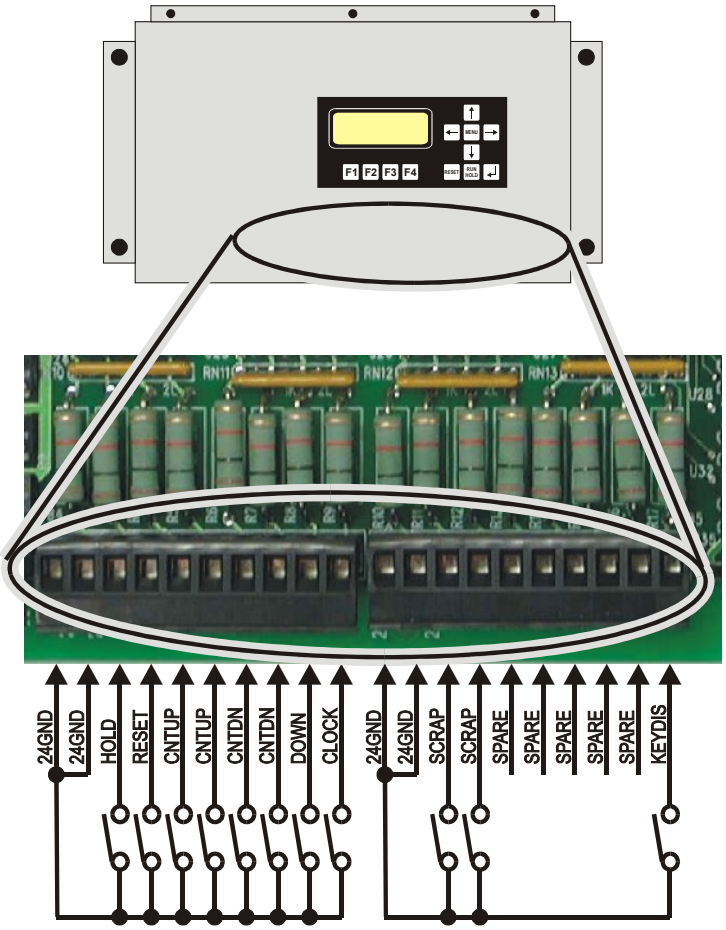
(2) CNTUP – Pulsing this input increments the actual counter. Use a photo eye or other sensor as appropriate with a relay contact or NPN output to pulse this input as product is completed. The maximum count rate is 10Hz with a 50% duty cycle waveform. Count pulses must be a minimum of 50mS wide, and be separated by a minimum of 50mS of off time. **NOTE: To disable the CNTUP inputs during breaks/hold, set switch 4 on the SW2 dip switch to the ON position.**

(2) CNTDWN – Pulsing this input decrements the actual counter. This input is typically used to provide the operator a manual pushbutton which is used to "back out" parts that fail finished product testing. **NOTE: To disable the CNTDWN inputs during breaks/hold, set switch 4 on the SW2 dip switch to the ON position.**

(2) SCRAP – Pulsing this input increments the scrap counter and optionally decrements the actual counter. Use a photo eye or other sensor as appropriate with a relay contact or NPN output to pulse this input as defective product is detected. **NOTE: To disable the SCRAP inputs during breaks/hold, set switch 4 on the SW2 dip switch to the ON position. To also decrement the actual counter when the SCRAP input is pulsed, set switch 5 on the SW2 dip switch to the ON position.**

DOWN – Activate this input during line down conditions. If the down input is activated, and the PPT is not held for a break, then the down time timer accumulates time. If the down input is not activated, and the PPT is not held for a break, then the up time timer accumulates time. If the PPT is held for a break, nether up nor down time timers accumulate time regardless of the state of the down input.

KEYDIS – Disables the keypad on the front of the LCD control box. Typically this input is connected to a key lock switch to prevent unauthorized access to the PPT.



1.9 Installing PPT Control Box Silicon Relay Output Wiring

The PPT control box provides the following 120VAC silicon relay outputs. Each output supplies 120VAC power at up to ½ amp of current for resistive loads. For inductive loads, the maximum current draw is reduced to 1/10th amp.

DONE – The control box turns the done output on when the actual count is greater than or equal to the shift goal setting. The done output is typically used to illuminate a lamp or activate a tune to indicate that production has completed the required number of units.

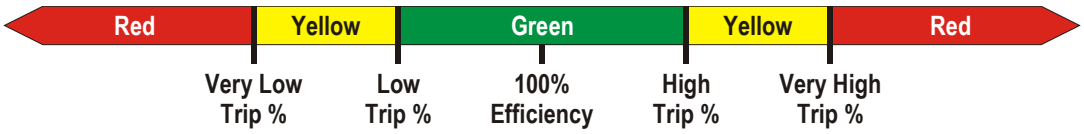
PDONE (Pulsed Done) – The control box turns the pulsed done output on for two seconds when the actual count reaches the shift goal setting. The pulsed done output may be used to activate a loud horn or other momentary device to indicate that production has completed the required number of units.

OVER – The control box turns the over output on when the actual takt timer reaches zero. The over output is typically used to illuminate a lamp or activate a tune to indicate that production has exceeded the alloted time.

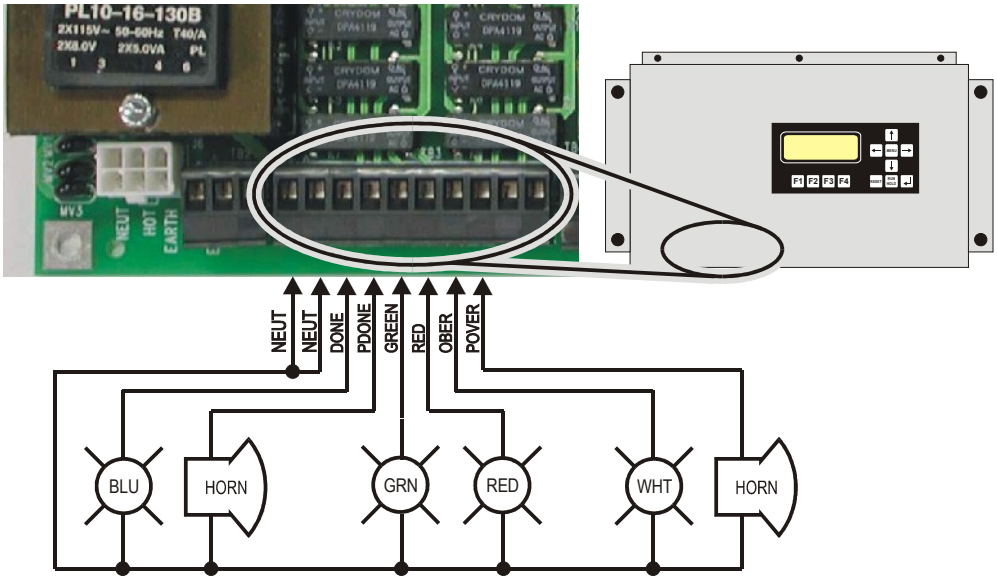
POVER (Pulsed Over) – The control box turns the pulsed over output on for two seconds when the actual takt timer reaches zero. The pulsed over output may be used to activate a loud horn or other momentary device to indicate that production has exceeded the alloted time.

GREEN / RED – The green and red relay outputs are designed to control an American LED-gible tri-color andon block with green and red LED circuits. The control box activates the green output to make the andon block illuminate green. The control box activates the red output to make the andon block illuminate red. The control box activates both the red and the green outputs at the same time to make the andon block illuminate yellow.

Even though the outputs are designed to be used with ALI andon blocks, they may be used with other signaling devices such as standard red/green stack lights or audible tune devices if desired.



Note: The very low, low, high, and very high trip points are set by the system operator using the LCD display and keypad on the PPT control Box.



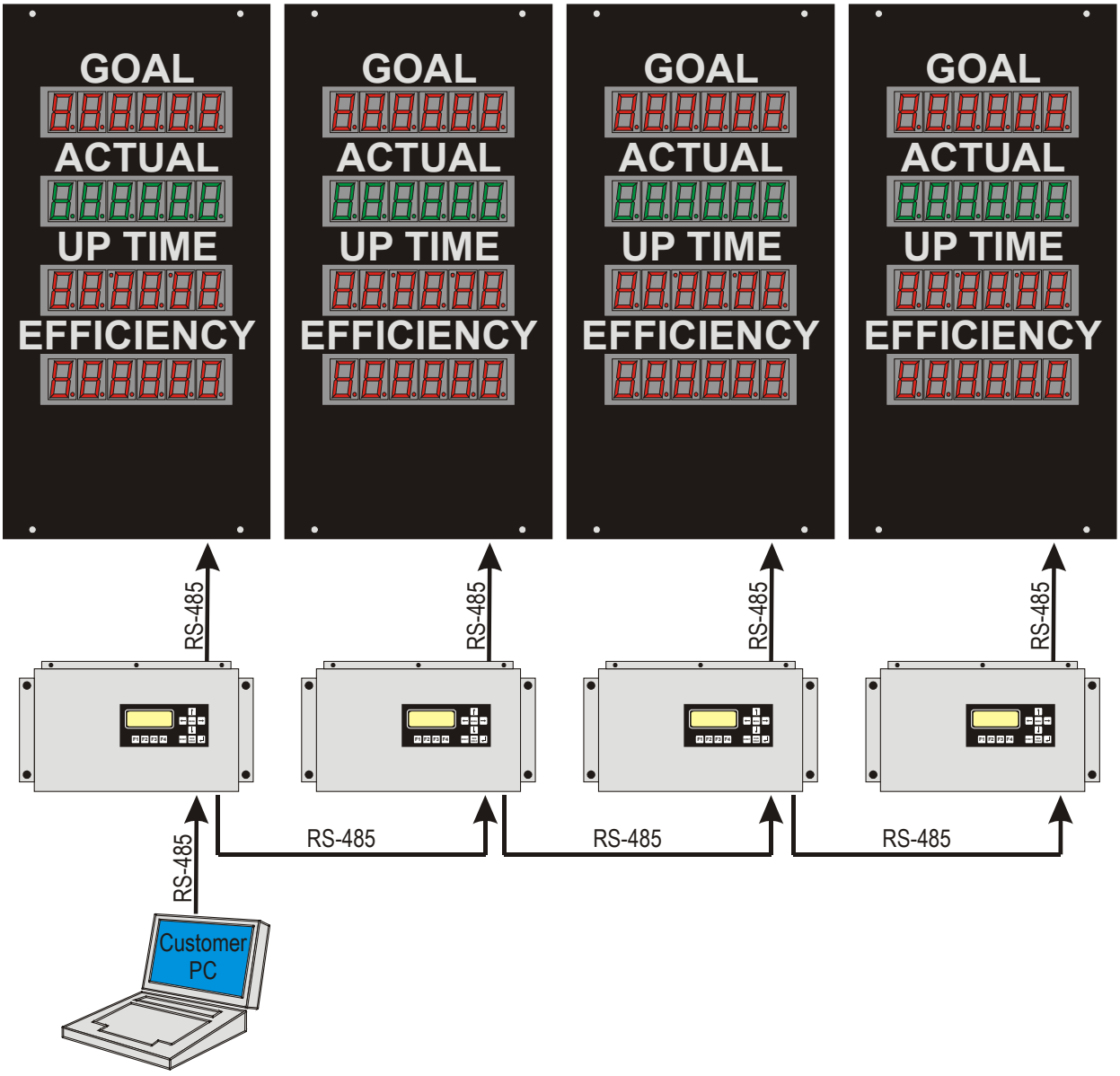
Typical 120VAC Relay Wiring

1.10 The Supervisor Serial Port

Use of the PPT control box supervisor serial port is an optional advanced feature.

It is the customers responsibility to write the PC application that is used to retrieve data from and send data to the PPT control box. Typically this application is tightly integrated into existing plant systems making a "one size fits all" solution impossible.

Many installations will not use the supervisor serial port, rendering serial port wiring and configuration unnecessary. However, if use of the supervisor serial port is desired, it is still advisable to first complete and test a basic installation, and then add use of the supervisor serial port later. For this reason, wiring and configuration of the supervisor serial port is covered in the chapter that discuss the supervisor interface.



2.0 Basic PPT Operation

Now that system wiring has been completed, apply power to the Marquee and PPT control box.

When power is applied to the marquee, it will perform power on self tests, display configuration, blank out all display fields, and then wait for data to arrive from the PPT control box.

When power is applied to the PPT control box, it will perform power on self tests, sanity check data stored in super-cap backed up ram, display system status on the LCD, and then begin sending data to the marquee.

Data should appear on every line of the marquee. If the marquee does not appear to be working properly, remains blank, or displays dashes, please check the power and RS-485 communications wiring, and then call American LED-gible.® Please do not flip any switches or move any jumpers before calling A.L.I. The factory configures and carefully tests every unit before shipping them to the customer.

The next step is to validate that the customer supplied photo-eye or other sensor, wired to the CNTUP input is working. Manually operate the sensor and verify that the actual counter increments. Note that the count "scaling factor" is programmable, so for now, just verify that activating the sensor makes the actual count change. We will be setting the "scaling factor" later. If the actual count does not change, try manually shorting the CNTUP input to 24GND with a jumper wire, while observing the red input indicator lamps in the control box.

Note: Count pulses must be a minimum of 0.05 seconds long, and there must be a minimum of 0.05 seconds spacing between pulses. This corresponds with a 10Hz 50% duty cycle square wave, which is the fastest pulse train that the PPT control box can reliably process.

Next manually test and verify operation of each of the optional logic inputs you will be using in your installation (HOLD, RESET, CNTDWN, DOWN, CLOCK, SCRAP). If any input appears to not be working, try manually shorting that input to 24GND using a jumper wire while observing the red input indicator lamps in the control box.

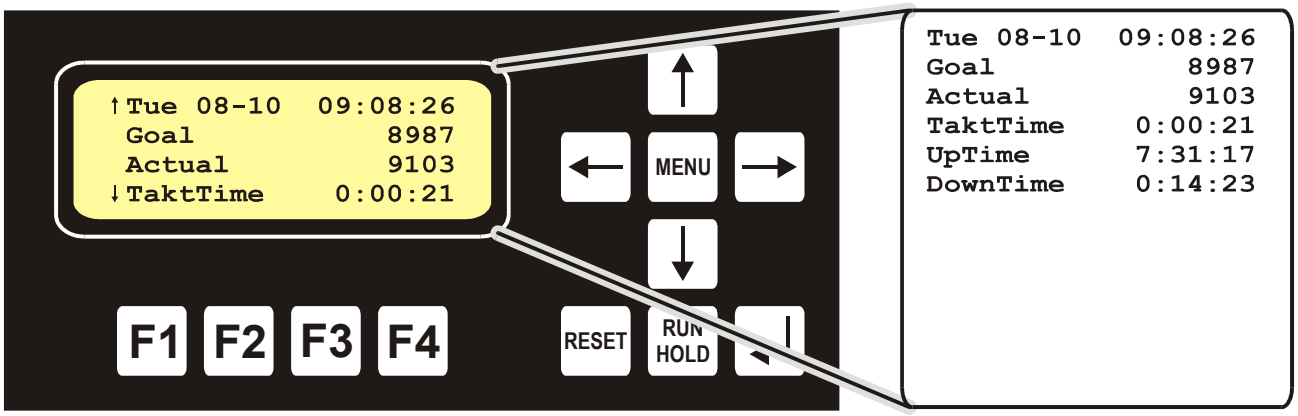
2.1 PPT Control Box LCD and Operator Keypad

The PPT control box has a liquid crystal display (LCD) and operator keypad, which is shown below. The menu, up arrow, down arrow, left arrow, right arrow, and enter (↵) keys are used to access the PPT menu system. The reset key, resets the PPT counters and timers to zero. The run/hold key is used to manually hold the PPT during breaks. The F1, F2, F3, and F4 keys are not currently used with this version of the PPT control box firmware, however future version of the firmware may use these keys for special functions.

2.2 The PPT Status Screen

When power is applied to the PPT control box, the PPT status screen is displayed, as shown below. The up/down arrows displayed on the left side of the LCD screen indicate that there is more information available than will fit on the LCD at the same time, and the operator can use the up/down arrow keys on the keypad to scroll through the available information.

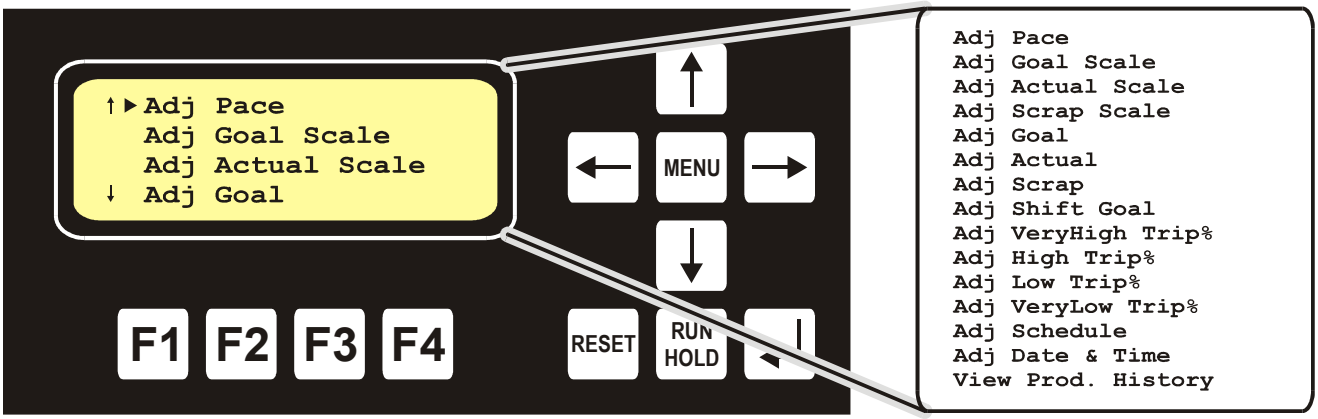
The PPT status screen displays the current date/time, goal count, actual count, takt time remaining, accumulated up time, and accumulated down time production metrics. Only four of which can fit on the LCD at the same time. In order to view other production metrics, use the up/down arrow keys on the keypad to scroll through the list.



2.3 Accessing the Main Menu

The PPT control box has ninety one settings that can be modified using the LCD/keypad. Press the menu key to access the main menu, which is shown below. Similar to the status screen, up and down arrows are shown on the left side of the LCD to indicate that the menu can be scrolled up and down.

The menu has a selection triangle on the left side of the LCD screen which points at the current menu selection. Pressing the up/down arrow keys on the keypad moves the selection triangle up/down. When the selection triangle reaches the top or the bottom of the LCD, the menu will scroll to bring other menu options into view. Once the selection triangle points at the desired menu item, pressing the enter (↵) key activates the selected menu option. Alternately, pressing the menu key again cancels the current screen/menu, and backs up to the previous screen/menu.



Adj Pace
allows the operator to change the pace time setting, which controls the time interval between goal counter increments. The PPT maintains a takt timer, which starts at the programmed pace setting, and times down to zero (if the PPT is not held for break). When the takt timer reaches zero, the goal counter is incremented, and the takt timer is reset to the programmed pace setting, and begins to time down again. Pace can range from a minimum of 0.50 seconds to a maximum of 9999.99 seconds.

Adj Goal Scale
allows the operator to change the goal counter scaling factor which controls the goal counter increment quantity. Each time the takt timer reaches zero, the goal counter is incremented by the value stored in the goal scale setting. Goal scale can range from a minimum of 1 to a maximum of 999999.

Adj Actual Scale
allows the operator to change the actual counter scaling factor which controls the actual counter increment/decrement quantity. Each time either CNTUP input is pulsed, the actual counter is incremented by the value stored in the actual scale setting. Each time either CNTDWN input is pulsed, the actual counter is decremented by the value stored in the actual scale setting. Actual scale can range from a minimum of 1 to a maximum of 999999.

Adj Scrap Scale
allows the operator to change the scrap counter scaling factor which controls the scrap counter increment quantity. Each time either SCRAP input is pulsed, the scrap counter is incremented by the value stored in the scrap scale setting. If switch 5 on the SW2 dip switch is turned on, then the control box will also decrement the actual counter by the value stored in the scrap scale setting each time either SCRAP input is pulsed. Scrap scale can range from a minimum of 1 to a maximum of 999999.

Adj Goal
allows the operator to directly adjust the goal counter. Under most circumstances this should be unnecessary, but is provided to allow the operator to recover from situations where the goal count is incorrect. Goal may range from a minimum of 0 to a maximum of 999999.

Adj Actual
allows the operator to directly adjust the actual counter. Under most circumstances this should be unnecessary, but is provided to allow the operator to recover from situations where the actual counter is incorrect. Actual may range from a minimum of 0 to a maximum of 999999.

Adj Scrap
allows the operator to directly adjust the scrap counter. Under most circumstances this should be unnecessary, but is provided to allow the operator to recover from situations where the scrap counter is incorrect. Actual may range from a minimum of 0 to a maximum of 999999.

Adj Shift Goal
allows the operator to set the end of shift goal. When the actual counter reaches the entered shift goal, the control box turns on the DONE relay output, and pulses the PDONE relay output. Shift goal may range from a minimum of 0 to a maximum of 999999.

Adj Very High Trip%
allows the operator to set the very high efficiency trip point. Normally the green output is on, and the red output is off. If the very high efficiency trip point is exceeded then the green output turns off, and the red output turns on. The very high efficiency trip point may range from a minimum of 0.01% to a maximum of 9999.99%. Setting any trip point to 0.00% disables the trip point.

Adj High Trip%
allows the operator to set the high efficiency trip point. Normally the green output is on, and the red output is off. If the high efficiency trip point is exceeded then the green output remains on, and the red output turns on as well. The high efficiency trip point may range from a minimum of 0.01% to a maximum of 9999.99%. Setting any trip point to 0.00% disables the trip point.

Adj Low Trip%
allows the operator to set the Low efficiency trip point. Normally the green output is on, and the red output is off. If the low efficiency trip point is exceeded then the green output remains on, and the red output turns on as well. The low efficiency trip point may range from a minimum of 0.01% to a maximum of 9999.99%. Setting any trip point to 0.00% disables the trip point.

Adj Very Low Trip%
allows the operator to set the very low efficiency trip point. Normally the green output is on, and the red output is off. If the very low efficiency trip point is exceeded then the green output turns off, and the red output turns on. The very high efficiency trip point may range from a minimum of 0.01% to a maximum of 9999.99%. Setting any trip point to 0.00% disables the trip point.

Adj Schedule
allows the operator to access the shift/break schedule sub-menu. This feature will be discussed in a later chapter of the manual.

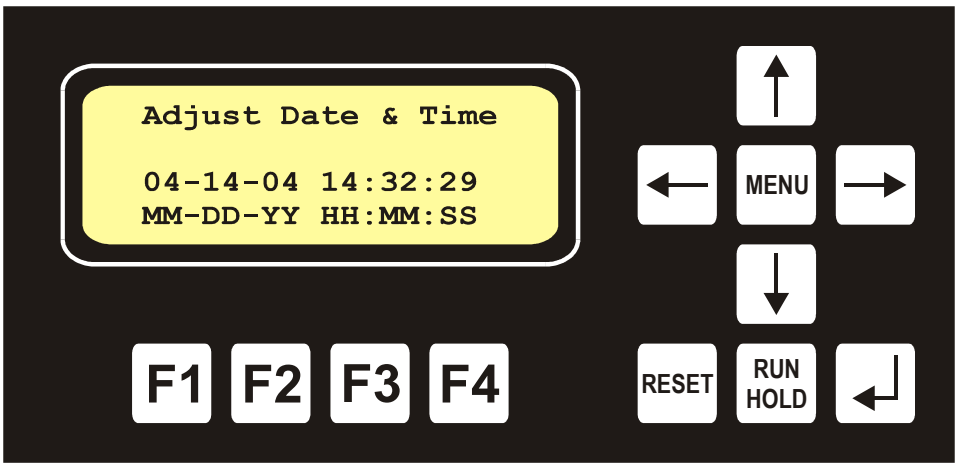
Adj Date & Time
allows the operator to set the PPT control box real time clock. In the next section of this manual, we will set the PPT real time clock in order to become familiar with the procedure used to change any PPT setting.

View Prod. History
Allows the operator to retrieve archived production totals. Each time the PPT is reset by any method (keypad, logic input, or automatic shift schedule) the accumulated production data is saved in the production history archive. This feature will be discussed in a later chapter of the manual.

2.4 Setting the Real Time Clock

Now that you know how to access the PPT main menu, it is time to learn how to use the LCD and keypad to "dial in" PPT settings. A good way to practice "dialing in" settings is to set the real time clock chip to the correct date and time, which we will do now.

To set the real time clock, press the menu key to summon the main menu, use the up and down arrow keys to make the selection triangle point at the "Adj Date & Time" menu option, and then press the enter (↵) key to summon the adjust date and time screen, which is shown below.



The left most digit of the current date/time will have a blinking cursor. Use the left and right arrow keys to select each digit in the date/time, and then use the up and down arrow keys to change the selected digit. Throughout the rest of the manual we will refer to this procedure as "dialing in" the setting.

Note: The clock uses 24 hour time format. 2:00PM is entered as 14:00:00.
Note: The clock automatically computes the weekday from the month, day, and year.

Once the correct month, day, year, hour, minute, and second is entered, press the enter (↵) key to set the real time clock, or press the menu key to exit this screen without setting the clock.

The RTC (real time clock) chip is rated for an accuracy of plus or minus fifty parts per million. This equates with a worst case clock drift of about five seconds per day. However, typical performance is much better. In our lab, RTC drift was measured to be only a couple seconds per week.

In order to cancel out clock drift and keep the RTC synchronized with the factory master clock, a clock logic input is provided. Pulse this input on the hour (typically midnight and/or noon) at least once per day to keep the RTC synchronized with the assembly plant time-clock system. It is acceptable to pulse the clock input as frequently as once an hour if very tight synchronization with the master clock is required.

The RTC chip automatically adjusts for leap year, but does not automatically adjust for daylight savings time. If you obey daylight savings time in your locality, twice per year you will need to manually advance or retard the RTC one hour. This can be done manually using the keypad, or it can be accomplished by sending a command to the optional supervisor interface which is described in a later chapter of this manual.

The RTC chip draws power from the 120VAC line when the control box is powered up, and it draws power from a 1F super-cap when control box power is removed. The RTC can run on super-cap power for five days with little additional drift. However, past five days, the RTC will drift progressively more each day as the super-cap discharges. When power is restored to the control box, the super-cap recharges to full power in about 30 seconds.

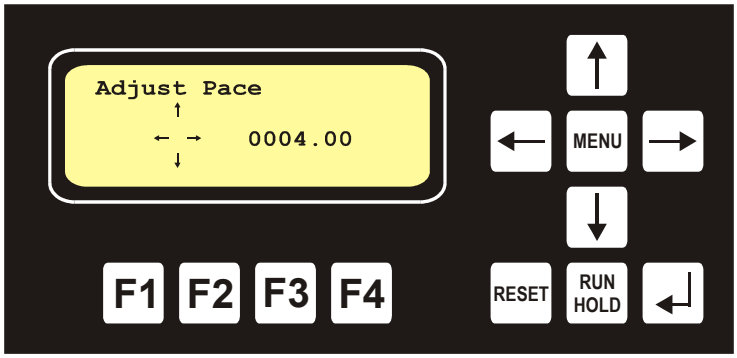
2.5 Pacing a Production Process

Now that you know how to "dial in" PPT settings, we will now walk through configuring a PPT to pace a simple production process. For this first example, to keep things simple, we will disable the automatic shift/break feature and avoid using any optional inputs or outputs. Lets begin...

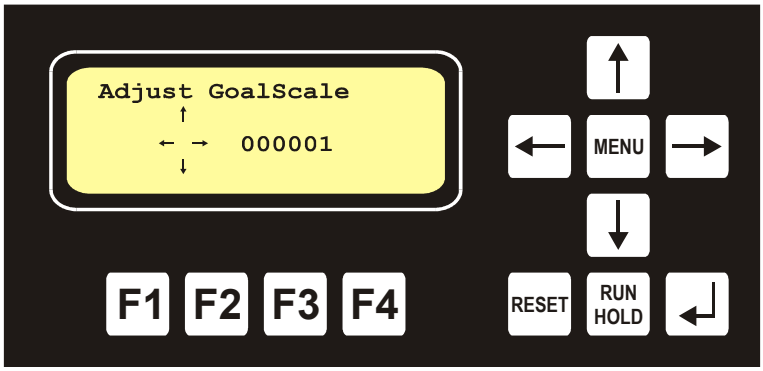
> Widget Co. the worlds leading manufacturer of widgets wishes to pace the widget production process, preventing both over and under production while simultaneously improving widget consistency and quality. It takes four seconds to produce each widget, and widgets are packaged into cases of six. The CNTUP input of the PPT control box is wired to a photo-eye that detects finished cases of widgets as they come off the assembly line.
>
> Management decides that the goal counter should increment by one every four seconds. The actual counter should increment by six for each completed case of widgets. The line supervisor will manually reset and hold the PPT for each shift and break using the keypad.

To configure the PPT control box as directed by Widget Co. management, use the following procedure.

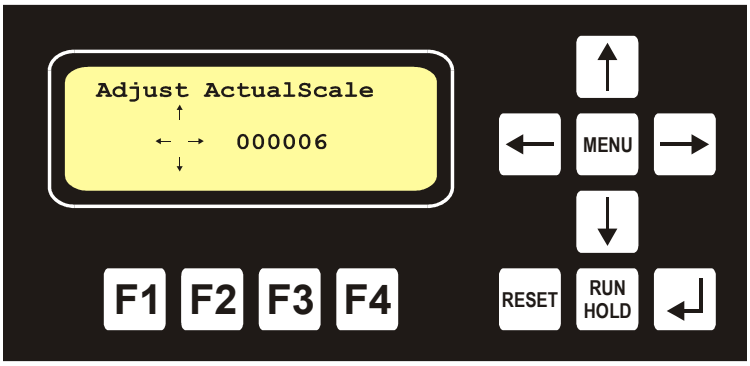
1) Use the MENU key to summon the main menu, and then select the "Adj Pace" option, which will summon the adjust pace screen, as shown below. Use the left and right arrow keys to select digits in the pace setting. Use the up and down arrow keys to increment and decrement the selected digit. After "dialing in" the new 0004.00 second pace setting, press the enter (↵) key to save the change. This programs the goal counter to increment once every four seconds.



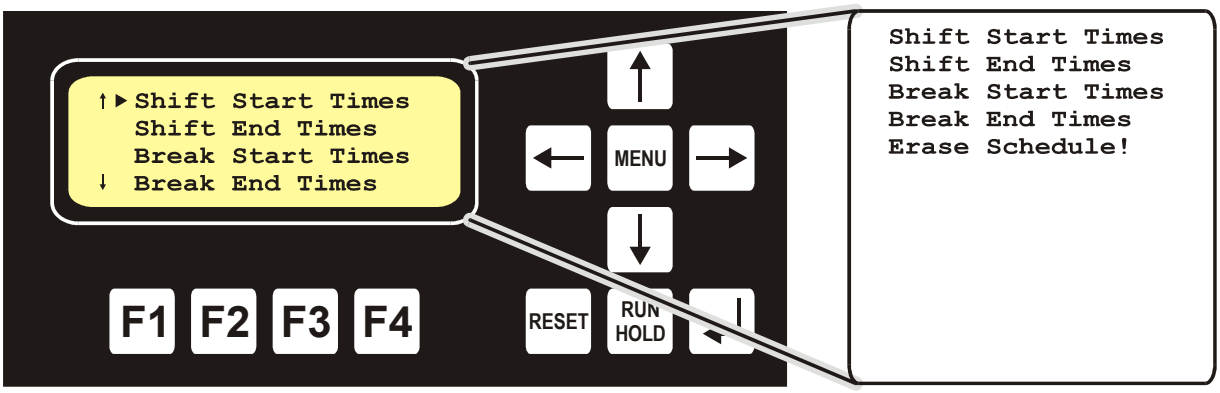
2) Select the "Adj Goal Scale" main menu option, which will summon the adjust goal scale screen, as shown below. "Dial in" a goal scale setting of 000001, and then press the enter (↵) key to save the change. This programs the goal counter to increment by one.



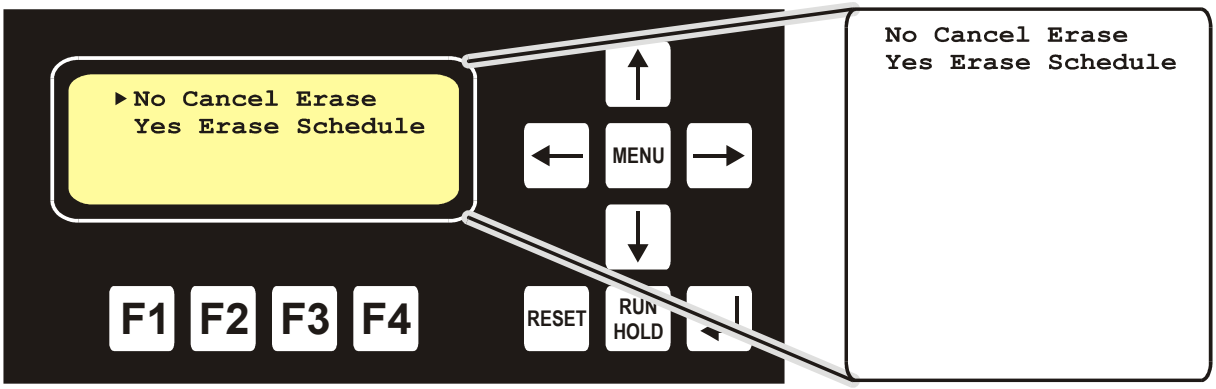
3) Select the “Adj Actual Scale” main menu option, which will summon the adjust actual scale screen, as shown below. “Dial in” an actual scale setting of 000006, and then press the enter (↵) key to save the change. This programs the actual counter to increment by six each time the photo-eye/sensor detects a case.



4) For this example, we need to make sure that the automatic shift/break schedule feature is disabled. Select the “Adj Schedule” main menu option, which will summon the automatic shift/break schedule sub-menu as shown below.



Scroll to the bottom of the schedule sub-menu and select the “Erase Schedule!” option. The PPT will ask you to confirm that you really wish to erase the schedule as shown below.



Select the “Yes Erase Schedule” option to erase all scheduling information, which will disable the automatic shift/break schedule feature. Press the menu key twice to return to the PPT status screen.

The PPT control box is now setup to pace the widget production process. Press the reset key to reset the goal/actual counters to zero.

Observe the TaktTime line of the PPT status screen. If the takt timer is not timing down, then the PPT is held for break, press the run/hold key on the keypad to release the PPT, and the takt timer will begin timing down.

Begin producing widgets, and try to keep the goal and actual counts the same throughout the shift. Assembling product at a comfortable, constant pace is the key to improving product consistency, quality, and achieving maximum benefit from your investment an American LED-gible® production pace timer.

At the start of each planned break, press the run/hold key to "hold" the PPT during the break. The takt time timer will pause, which also pauses the goal counter.

At the end of each break, press the run/hold key again to release the hold. The takt time timer will resume timing down, which also causes the goal counter to resume incrementing at the programmed rate.

At the end of the shift, press the run/hold key to stop the PPT goal counter. The actual counter will continue to increment as finished product is completed, which allows production to work over and catch up if they are slightly behind. When everyone is finished, record the production goal and actual totals for the shift.

> After running the above PPT configuration for a few days, production complains that it is not fair that the goal counter increments by one unit every four seconds if the actual counter is incrementing by six each time a case is completed. In the interest of fairness, production formally requests that the PPT be reconfigured to increment the goal counter by six units (a full case of widgets) every twenty four seconds. After a short and productive meeting, management agrees to the request.

To reconfigure the PPT control box as production requests, use the following procedure.

1) Change the pace setting from four seconds to twenty four seconds. To do this, summon the main menu and then select the "Adj Pace" option. "Dial in" the new pace setting of 24.00 seconds and then press the enter (↵) key to save it.

2) Change the goal scale setting from one to six. To do this summon the main menu and then select the "Adj Goal Scale" option. "Dial in" the new goal scaling factor of 000006 and then press the enter (↵) key to save it.

3) Reset the PPT, release hold, and begin assembling widgets.

2.6 Using the DONE and PDONE Silicon Relay Outputs

In addition to the auto-incrementing goal, the control box also has a fixed shift goal. When the actual counter reaches the programmed shift goal, the control box turns on the done output, and pulses the pulsed done output (two second pulse). This behavior is designed to support shift quotas, as the following Widget Co. example will demonstrate.

> Widget Co decides to set a quota of six thousand widgets per shift. Once production has completed the quota, they may halt production and go home. Management decides that they would like a horn to sound, and a blue stack light to illuminate once the quota has been met.

To implement the 6000 widget shift quota, using the following procedure:

1) Connect a blue stack light to the control box done output, and a loud horn to the pulsed done output.

2) Set the shift goal to six thousand. To do this summon the main menu and then select the "Adj Goal Scale" option. "Dial in" the new shift goal of 6000 widgets, and then press the enter (↵) key to save it.

When the actual counter reaches six thousand widgets, the control box will turn on the done output, illuminating the blue stack light, and will also pulse the pulsed done output, sounding the loud horn for two seconds.

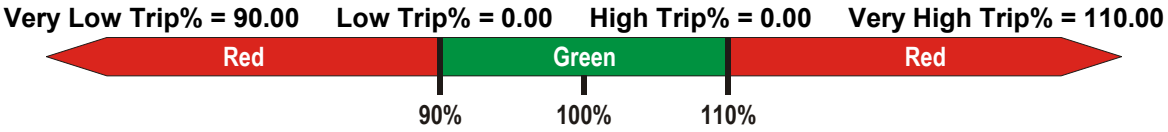
2.7 Using the GREEN and RED Silicon Relay Outputs

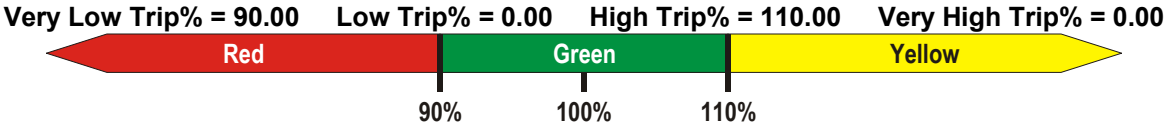
The control box computes a real time percent efficiency from the goal and actual counts. Efficiency values less than 100% mean that production is behind schedule. Efficiency values greater than 100% mean that production is ahead of schedule.

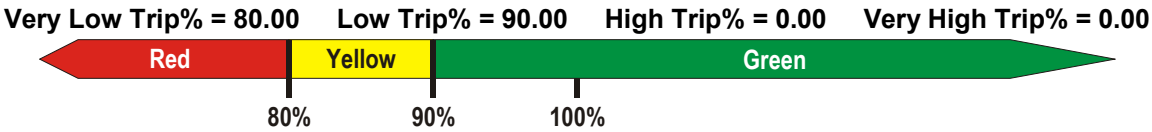
Very low, low, high, and very high efficiency trip points can be set to make the GREEN and RED outputs turn on/off when trip points are exceeded. This feature is designed to be used with American LED-gible tri-color andon blocks, but can be used with other devices such as stack lights, or tune playing audible alarms if desired.

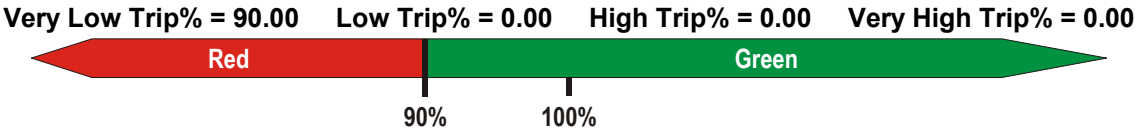
Normally the green output is turned on, and the red output is turned off, which makes the andon block illuminate green. If the low or high efficiency trip point is exceeded then the green output remains on, and the red output also turns on, which makes the andon block illuminate yellow. If the very low or very high efficiency trip point is exceeded, then the green output turns off, and the red output turns on, which makes the andon block illuminate red. A diagram of the trip points and resulting colors is shown below.

Any efficiency trip point can be disabled by setting it to 0.00%. This allows the system operator to program the control box to activate the GREEN and RED outputs in several different patterns, some of which are shown below. Remember that yellow is achieved by turning both the green and red outputs on at the same time.



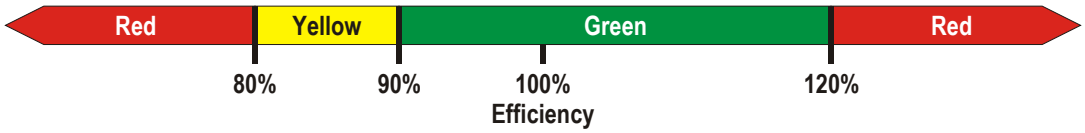






In the previous manual section Widget Co. setup a six thousand widget per shift quota. One of the problems with allowing production to break and go home once a quota is met, is that it encourages production to rush which can lead to decreased product quality. We will now use the relay outputs to give production additional feedback when production is ahead of or behind schedule.

> Widget Co discovers that the six thousand widget quota is encouraging production to rush excessively, which has reduced widget quality somewhat. To encourage production to maintain a more quality friendly pace, an ALI andon block is purchased and connected to the control box. Management decides that andon block should illuminate red when efficiency is less than 80% or greater than 120%. The andon block should illuminate yellow for efficiencies between 80% and 90%.



To make the andon block illuminate as directed by Widget Co. management, connect an ALI andon block to the PPT control box and dial in the following trip point settings.

```
Very Low Trip %  =  80.00
Low Trip %       =  90.00
High Trip %      =   0.00
Very High Trip % = 120.00
```

1) Connect the andon block to the control box green and red relay outputs.

2) Set the very low trip point to 80%. To do this summon the main menu and then select the “Adj VeryLow Trip%” option. “Dial in” the new 80.00% very low trip point, and then press the enter (↵) key to save it.

2) Set the low trip point to 90%. To do this summon the main menu and then select the “Adj Low Trip%” option. “Dial in” the new 90.00% low trip point, and then press the enter (↵) key to save it.

3) Disable the high trip point by setting it to 0%. To do this summon the main menu and then select the “Adj High Trip%” option. “Dial in” the new 0.00% high trip point, and then press the enter (↵) key to save it.

4) Set the very high trip point to 120%. To do this summon the main menu and then select the “Adj VeryHigh Trip%” option. “Dial in” the new 120.00% very high trip point, and then press the enter (↵) key to save it.

5) Reset the PPT, release hold, and begin assembling widgets. The andon block will now illuminate as directed to give production additional feedback.

Congratulations, you now know how to configure the PPT to pace any manual production process. In the next chapter we will add an automatic shift/break schedule. This will allow the PPT to automatically reset itself at the beginning of each shift and hold itself during planned breaks.

3.0 Using the Automatic Shift/Break Schedule

The PPT control box has an internal real time clock. This makes it possible for the control box to automatically save the previous shift totals in the production history archive and then reset the goal counter, actual counter, up timer, and down timer at the start of each shift. It also allows the PPT to automatically hold the takt timer and goal counter during breaks.

The PPT control box supports up to eight shifts and thirty two breaks per week. Each shift and break can be programmed to operate on any arbitrary selection of week days allowing split scheduling (Schedule-A Monday through Thursday, Schedule-B Friday through Sunday).

Please read this chapter carefully before attempting to program your schedule into the PPT. Shift/break schedules can be fairly complex, requiring as many as eighty settings be “dialed into” the control box for the most complex schedules.

3.1 Schedule Events

The automatic shift/break schedule is constructed from four types of events: shift start events; shift end events; break start events; and break end events.

Shift start events prepare the PPT to pace a shift. First, the previous shift production totals are stored in the production history archive. Second, the goal counter, actual counter, up timer, and down timer are reset to zero. Third, the takt timer is set in motion, which causes the goal counter to increment at the programmed rate.

Shift end events stop the takt timer and the goal counter. The accumulated goal count at the end of the shift is the total number of units production should have completed during the shift.

Break start events pause the takt timer and the goal counter. For the duration of the break, the goal counter will not increment, however the actual counter will continue to count if production continues assembling product.

Break end events release the takt timer allowing the goal counter to resume counting up at the programmed rate.

Events can be programmed to activate at any time of day, for any arbitrary combination of weekdays. For example, shift 1 start could be programmed to activate at 6:00AM Monday, Wednesday, and Friday, and shift 2 start could be programmed to activate at 6:30AM Tuesday and Thursday.

3.2 A Simple Shift/Break Schedule Example

When we last visited Widget Co, it was the line supervisor's responsibility to manually reset and hold the PPT each day using the keypad. We will now help him out by programming the PPT control box to automatically reset and hold at the appropriate times.

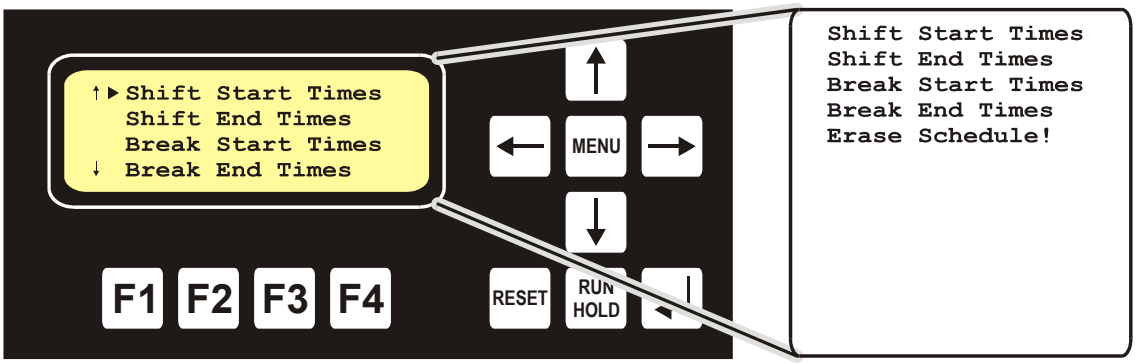
Initially Widget Co will be working a simple one shift Monday through Friday schedule. However later in this chapter, Widget Co. will be expanding to a full three shifts per week day, and one shift on weekends schedule.

> Management at Widget Co, happy with their initial success using the basic features of the PPT, now wish to use the automatic shift/break schedule feature. Being one of America's finest small business, Widget Co runs the typical one shift, Monday through Friday with three breaks including lunch, schedule. Widget production starts promptly at 6:00AM. First break is from 8:30AM to 8:45AM. Lunch break is from 11:00AM to 11:30AM. Second break is from 1:30PM to 1:45PM. Widget production ends at 3:00PM.

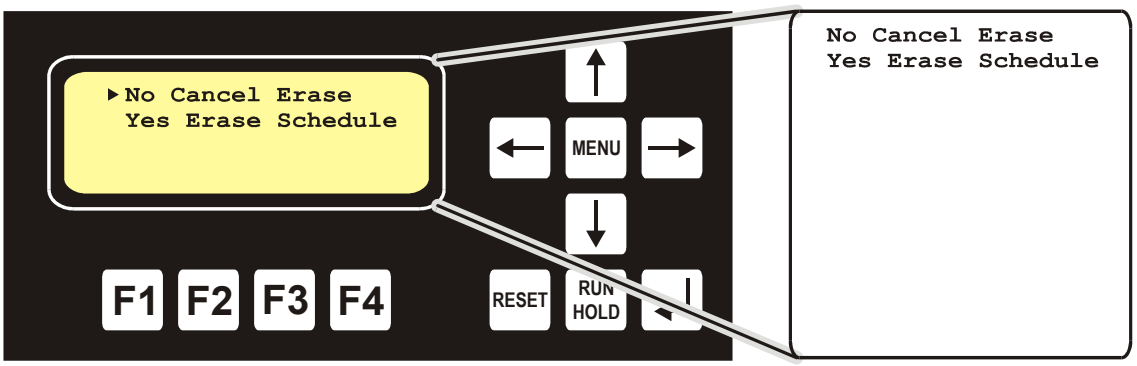
Programming the PPT for this simple schedule is quite easy. We will only need to program one shift start event, one shift end event, three break start events, and three break end events.

Before programming the new shift/break schedule into the PPT, it is probably a good idea to completely erase the old schedule first. If one of the old scheduled events were accidentally left programmed into the PPT, it could create a lot of confusion until the error was discovered and corrected.

To erase the old schedule, select the "Adj Schedule" main menu option, which will summon the automatic shift/break schedule sub-menu as shown below.

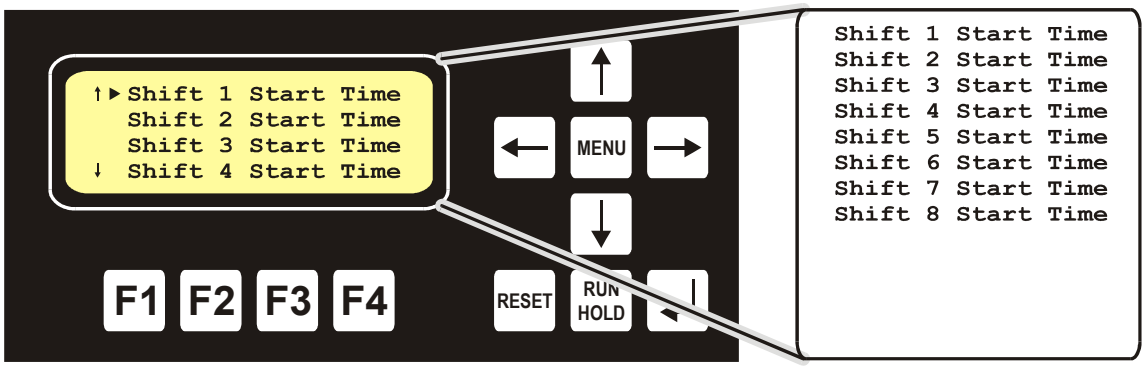


Scroll to the bottom of the schedule sub-menu and select the "Erase Schedule!" option. The PPT will ask you to confirm that you really wish to erase the schedule as shown below.



Select the "Yes Erase Schedule" option to erase the old schedule. Now that the old schedule is erased, we will begin programming the simple Widget Co. schedule into the PPT.

First we need to setup a shift start event, that will activate at 6:00AM on Monday, Tuesday, Wednesday, Thursday, and Friday. We will program this event into the Shift 1 Start setting. Select the "Shift Start Times" menu option from the schedule sub-menu. This will summon another menu that has options for setting "Shift 1 Start Time" through "Shift 8 Start Time" as shown below.



Select the “Shift 1 Start Time” menu option, which will bring up the shift 1 start time entry screen as shown below.

All of the event time entry screens use the same “dial in” technique that you are already experienced using.

To the left, are seven day flags, one for each day of the week, **S**unday, **M**onday, **T**uesday, **W**ednesday, **T**hursday **F**riday, and **S**aturday. If a day flag shows a letter, then the event is active for that day of the week. If a day flag shows a “**-**” instead, then the event is not active for that day of the week. In the image above the day flags are set to “**-MTWTF-**” indicating that the event is active Monday through Friday, and is not active on Sunday or Saturday.

To the right is a time of day field in the usual hours, minutes, and seconds format.

Note that times are entered in 24 hour format. For example 3:00PM is entered as 15:00:00.

To “dial in” the shift 1 start time, use the left and right arrow keys on the keypad to select each day flag and digit in the event time entry. Then use the up and down arrow keys to change the selected flag/digit to the desired value.

When you are done “dialing in” the event, the LCD should look like the picture shown above. Press the enter (↵) key to save the setting, then press the menu key to return to the schedule sub-menu.

Use the same “dial in” technique to set the the other required schedule settings. A table is provided below to help you remember all of the required event entries.

Widget Co. Scheduled Event	*PPT Event Setting Used*	*PPT Event Setting*
Shift Start, Monday through Friday, 6:00AM	**Shift 1 Start Time**	**-MTWTF- 06:00:00**
1st Break Start, Monday through Friday, 8:30AM	**Break 1 Start Time**	**-MTWTF- 08:30:00**
1st Break End, Monday through Friday, 8:45AM	**Break 1 End Time**	**-MTWTF- 08:45:00**
Lunch Start, Monday through Friday, 11:00AM	**Break 2 Start Time**	**-MTWTF- 11:00:00**
Lunch End, Monday through Friday, 11:30AM	**Break 2 End Time**	**-MTWTF- 11:30:00**
2nd Break Start, Monday through Friday, 1:30PM	**Break 3 Start Time**	**-MTWTF- 13:30:00**
2nd Break End, Monday through Friday, 1:45PM	**Break 3 End Time**	**-MTWTF- 13:45:00**
Shift End, Monday through Friday, 3:00PM	**Shift 1 End Time**	**-MTWTF- 15:00:00**

As you can see from the table above, programming the simple Widget Co. schedule into the PPT control box is not that difficult. The next manual section will cover a far more expansive schedule.

3.3 A Complex Shift/Break Schedule Example

If you have not already read section **3.2 A Simple Shift/Break Schedule Example**, please do so before continuing with this section. This example adds quite a bit more complexity to the schedule and we will be assuming that you already know how to "dial" event times into the PPT, which was explained in section 3.2.

Our friends at Widget Co. are on the move again.

> Widget Co. decides to take the next step in growing the company, and sets up an e-commerce web site to directly market widgets world wide. The new web sight is successful beyond their wildest dreams and demand for widgets shoots through the roof. To keep pace with the sudden increase in demand, Widget Co adds a 2nd and 3rd shift to Monday through Friday, and even adds a 4th shift on Saturday and Sunday.

Widget Co's new schedule is summarized in the following tables. Please take the time to read the notes following each table, taking special interest in the 3rd shift table. Since 3rd shift spans across midnight, the shift begins Monday night, but ends Tuesday morning, which has an impact on the proper day flag settings.

1st Shift, Monday through Friday

Widget Co. Scheduled Event		*PPT Event Setting Used*	*PPT Event Setting*
Shift Start	6:00AM	`Shift 1 Start Time`	`-MTWTF- 06:00:00`
Break Start	8:15AM	`Break 1 Start Time`	`-MTWTF- 08:15:00`
Break End	8:30AM	`Break 1 End Time`	`-MTWTF- 08:30:00`
Break Start	10:30AM	`Break 2 Start Time`	`-MTWTF- 10:30:00`
Break End	11:00AM	`Break 2 End Time`	`-MTWTF- 11:00:00`
Break Start	12:45PM	`Break 3 Start Time`	`-MTWTF- 12:45:00`
Break End	1:00PM	`Break 3 End Time`	`-MTWTF- 13:00:00`
Shift End	1:55PM	`Shift 1 End Time`	`-MTWTF- 13:55:00`

1st shift is very similar to the simple example from the previous manual section, although the schedule has been condensed slightly to make room for the added 2nd and 3rd shifts. Remember that PPT event times are entered in 24 hour format. With nothing special to note here, lets press on to 2nd shift.

2nd Shift, Monday through Friday

Widget Co. Scheduled Event		*PPT Event Setting Used*	*PPT Event Setting*
Shift Start	2:00PM	**Shift 2 Start Time**	**-MTWTF- 14:00:00**
Break Start	4:15PM	**Break 4 Start Time**	**-MTWTF- 14:15:00**
Break End	4:30PM	**Break 4 End Time**	**-MTWTF- 14:30:00**
Break Start	6:30PM	**Break 5 Start Time**	**-MTWTF- 18:30:00**
Break End	7:00PM	**Break 5 End Time**	**-MTWTF- 19:00:00**
Break Start	8:45PM	**Break 6 Start Time**	**-MTWTF- 20:45:00**
Break End	9:00PM	**Break 6 End Time**	**-MTWTF- 21:00:00**
Shift End	9:55PM	**Shift 2 End Time**	**-MTWTF- 21:55:00**

Again fairly simple. Note that the three 2nd shift breaks are programmed into the PPT Break 4, Break 5, and Break 6 settings. This is because PPT Break 1, Break 2, and Break 3 are already allocated to 1st shift breaks.

Moving on to the 3rd shift schedule.

3rd Shift, Monday through Friday

Widget Co. Scheduled Event		*PPT Event Setting Used*	*PPT Event Setting*
Shift Start	10:00PM	**Shift 3 Start Time**	**-MTWTF- 22:00:00**
Break Start	12:15AM	**Break 7 Start Time**	**--TWTFS 00:15:00**
Break End	12:30AM	**Break 7 End Time**	**--TWTFS 00:30:00**
Break Start	2:30AM	**Break 8 Start Time**	**--TWTFS 02:30:00**
Break End	3:00AM	**Break 8 End Time**	**--TWTFS 03:00:00**
Break Start	4:45AM	**Break 9 Start Time**	**--TWTFS 04:45:00**
Break End	5:00AM	**Break 9 End Time**	**--TWTFS 05:00:00**
Shift End	5:55AM	**Shift 3 End Time**	**--TWTFS 05:55:00**

Here we see the slightly tricky problem with shifts that span across midnight. Remember, 3rd shift employees begin work at 10:00PM Monday night, but they take their first break at 12:15AM Tuesday morning. Likewise, 3rd shift employees begin work at 10:00PM Friday night, but they take their first break at 12:15AM Saturday morning. As you can see, since the shift spans across midnight, the day flags for the AM events must be shifted one weekday to the right as shown in the above table. Be very careful when setting the day flags for any shift that spans across midnight.

1st Shift, Saturday and Sunday (AKA 4th Shift)

Widget Co. Scheduled Event		*PPT Event Setting Used*	*PPT Event Setting*
Shift Start	8:00AM	**Shift 4 Start Time**	**S-----S 08:00:00**
Break Start	10:15AM	**Break 10 Start Time**	**S-----S 10:15:00**
Break End	10:30AM	**Break 10 End Time**	**S-----S 10:30:00**
Break Start	12:30AM	**Break 11 Start Time**	**S-----S 12:30:00**
Break End	1:00PM	**Break 11 End Time**	**S-----S 13:00:00**
Break Start	2:45PM	**Break 12 Start Time**	**S-----S 14:45:00**
Break End	3:00PM	**Break 12 End Time**	**S-----S 15:00:00**
Shift End	3:55PM	**Shift 4 End Time**	**S-----S 15:55:00**

Here we see the spillover weekend shift. Similar to 1st shift on Monday through Friday, but the day flags are set to restrict these events to only activate on Saturday and Sunday.

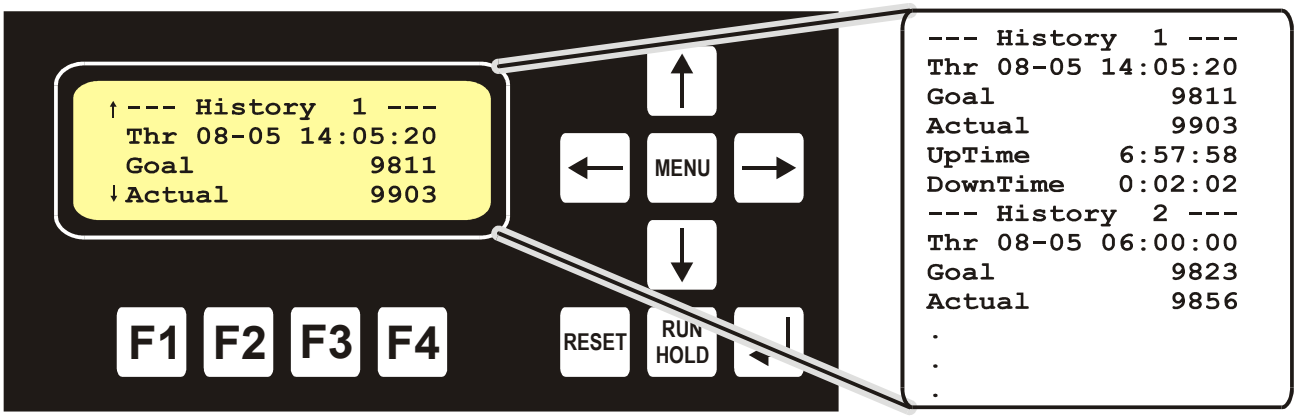
Congratulations, you now know how to program even the most complex of schedules into the PPT control box.

At this point it is likely that you have been using the PPT control box for at least a day or two. Every time that the PPT control box has been reset over the last couple of days, it has been storing production totals in the production history archive. The next chapter of the manual will explain how to access the archive, and retrieve historical production totals, using the LCD and keypad.

4.0 Viewing the Production History Archive

Every time the PPT control box is reset, the control box stores the date/time, goal count, actual count, up time, and down time in a production history archive which has room for twenty one entries. As new entries are added to the top of the archive, the oldest entry at the bottom of the archive is removed to make room.

To view production history, press the menu key to summon the main menu, and then use the up and down arrows to select the "View Prod. History" menu option, and then press the enter (↵) key. This will summon the production history screen shown below.



There are one hundred twenty six lines of information in the archive (21 entries, 6 lines long each), and you can scroll through the entire list using the up and down arrow keys as usual, however the control box provides a shortcut. Use the right/left arrow keys scroll the screen to the next/previous entry with just one key press.

When you are finished viewing the archive, simply press the menu key twice to return to the PPT status screen.

Congratulations, you have now learned everything a system operator needs to know about the PPT. The following chapter provides information your systems integrator will need if you intend to integrate the PPT into the existing plant SCADA system. So unless your a systems integrator, it's probably time to pat yourself on the back for a job well done and then take a well deserved break.

5.0 PPT Control Box Supervisory Control Interface

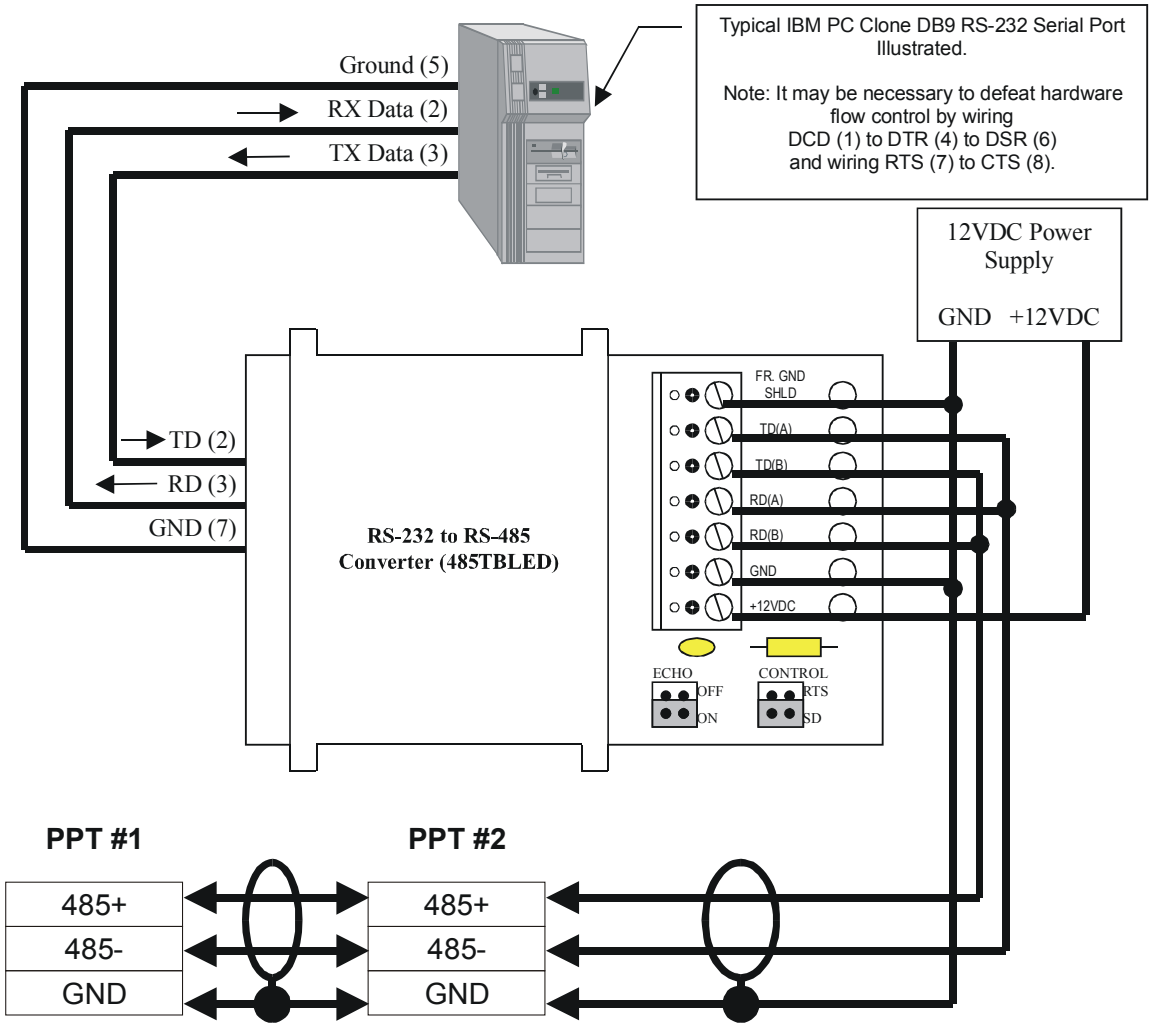
This chapter of the manual is written for use by the systems integrator developing the SCADA system for a network of PPT control boxes. It is assumed that the reader is technically proficient with computers, programming languages, and RS-485 communications networks.

The PPT control box Serial Port-2 can be used to both read and write the PPT settings over an RS-485 network. PPT control boxes are addressable allowing up to 63 control boxes to be managed from a single PC serial port.

5.1 Supervisor RS-485 Network Wiring

A three-conductor cable designed for serial communications will be needed. American LED-gible suggests using Belden 9463 “Blue Hose” cable.

Typically an RS-485 communications converter will be required to adapt the RS-232 port on the controlling PC to RS-485 communications. American LED-gible suggests using a model 485TBLED converter manufactured by B&B Electronics. This converter can be ordered by calling B&B at (815) 434-0846.



5.2 Control Box Switch Settings

Several switches need to be set in the control box to use the supervisory interface. If you are not using the supervisor interface, then none of the switches in the control box have any effect and do not need to be adjusted.

NOTE: Do not adjust any switches in the display marquee, these were set by the factory before shipment and never need adjustment.

On the control box processor, there are two 8-bit dip-switches labeled SW1 and SW2. SW1 selects the address character assigned to the control box. Any printable character (20H through 7EH) may be used as an address. SW1.1 is the least significant address bit, and SW1.7 is the most significant address bit. Turning a switch on sets the bit to a logic 1, and turning a switch off sets the bit to a logic 0. SW1.8 must always be set to OFF.

An ASCII chart is provided in the back of this manual, and can be used to lookup the hexadecimal ASCII code number for any character. The hexadecimal code number for 'A' is 41H, so to set the control box address to 'A' (41H) turn switches SW1.1 and SW1.7 ON, and leave all of the other switches OFF. Some of the possible address switch settings are shown in the table below.

SW1							
7	**6**	**5**	**4**	**3**	**2**	**1**	**Address**
40h	**20h**	**10h**	**08h**	**04h**	**02h**	**01h**	**Character**
ON	OFF	OFF	OFF	OFF	OFF	ON	A (41h)
ON	OFF	OFF	OFF	OFF	ON	OFF	B (42h)
ON	OFF	OFF	OFF	OFF	ON	ON	C (43h)
ON	OFF	OFF	OFF	ON	OFF	OFF	D (44h)
ON	OFF	OFF	OFF	ON	OFF	ON	E (45h)

SW2 switches 1, 2, and 3 select the supervisor serial port baud rate. To select 19200bps turn all three switches off. Other possible baud rates are shown in the table below.

SW2			
3	**2**	**1**	**Baud**
OFF	OFF	OFF	19200bps
OFF	OFF	ON	9600bps
OFF	ON	OFF	4800bps
OFF	ON	ON	2400bps
ON	OFF	OFF	1200bps
ON	OFF	ON	600bps
ON	ON	OFF	300bps
ON	ON	ON	150bps

5.3 Supervisor Commands

All supervisor commands begin with a CTRL-B character followed by the address character of the target control box, and end with a CTRL-C character. Three character opcodes are used to specify the desired command, and some opcodes require parameter data. If the control box accepts the command it will respond with an ACK character. If the control box rejects the command it will respond with a NAK character.

[CTRL-B] [address character] [3 character opcode] <parameter data> [CTRL-C]

The following opcodes are available in the AF-2450-057 PPT control box.

Opcode	*Description*
CRS	Command Reset, reset the PPT, equivalent to pulsing the reset logic input
CTS	Command Time Sync, equivalent to pulsing the clock sync logic input
CSF	Command Spring Forward, advance the time of day clock by one hour
CFB	Command Fall Back, retard the time of day clock by one hour
CRR	Command Read Registers, read back all PPT settings
CWR	Command Write Registers, write values into specified PPT settings

For example, to reset a PPT with an address of 'A' (41h) send the following 6 byte command:

CTRL-B A C R S CTRL-C

The control box will respond with a single ACK (CTRL-F, 06H) character to indicate that it accepted the command.

The PPT has several registers (settings) that can be read/written by by using the CRR/CWR command. Each register has a three character id code associated with it.

Reg ID Code	*Description*
RTC	Real Time Clock, number of seconds elapsed since 00:00:00 Jan 1 1970 (local time)
HLF	Hold Flag, 1=true 0=false
PAT	Pace Time in 1/100 of a second, i.e. 1234 = 12.34 seconds
TKT	Takt Time in 1/100 of a second, i.e. 1234 = 12.34 seconds
ATK	Actual Takt Time in 1/100 of a second, i.e. 1234 = 12.34 seconds
GOS	Goal Scale
ACS	Actual Scale
SCS	Scrap Scale
SGC	Shift Goal
GOC	Goal Count
ACC	Actual Count
SCC	Scrap Count
UPT	Up Time in 1/100 of a second, i.e. 1234 = 12.34 seconds
DWT	Down Time in 1/100 of a second, i.e. 1234 = 12.34 seconds

To change PPT registers (settings) using the supervisor interface, send a CWR command packet, and include **REGID=VALUE;** sequences in the parameter data section. For example to set the pace register to 34.5 seconds, and the hold flag to false, send the following 21 character command:

CTRL-B A C W R P A T = 3 4 5 0 ; H L F = 0 ; CTRL-C

To read back PPT settings, send a CRR command packet. The control box will respond with a ACK (CTRL-F) character followed by a complete dump of all registers surrounded by square bracket characters as shown below.

Send the following 6 character command:

CTRL-B A C R R CTRL-C

And the PPT responds with:

CTRL-F [R T C = 2 4 3 4 2 1 5 2 3 ; H L F = 1 ; P A T = 1 2 3 ; T K T = 9 6 ; A T K = 5 7 ; G O S = 1 ; A S C = 1 ; S C S = 1 ; G O C = 5 7 ; A C C = 1 2 3 ; S C C = 1 2 ; U P T = 2 3 3 ; D W N = 5 6 0 ;]

Note: The registers may be spilled in any order, future firmware revision may add additional registers, and register values are variable length. The current firmware never uses decimal points or colons in register values, but future version may.

6.0 Troubleshooting

Before contacting ALI for technical support, please review the manual sections covering installation and operation.

There are several status indicator lamps on the control box processor and the marquee display boards. Both the control box processor and the marquee display boards have POWER (Yellow) lamps. The POWER lamps are connected directly to the board 5VDC power supply. If a POWER lamp does not light, the 120VAC power wiring is probably incorrect.

The marquee display boards have RXD (Red), TXD (Green), and ENB (Yellow) serial communications lamps. When the display board is receiving data from the PPT control box the RXD and TXD lamps will “flicker”. If these lamps fail to illuminate check serial communications wiring.

The control box processor has three serial ports. Serial port 1 is used to send data to the marquee. The TXD1 lamp will flicker as the processor transmits data to the marquee. The flicker pattern of the TXD1 lamp should match the flicker pattern of the RXD lamp on the marquee display boards.

Serial port 2 is used to communicate with the optional supervisory control system. The TXD2 and RXD2 lights can be used to determine if the processor is communing with the supervisory control system.

Serial port 3 is not used in this product. The TXD3 and RXD3 lights should never illuminate.

The control box processor has 16 input status (Red) indicator lamps. When an input is activated the corresponding indicator lamp will illuminate. To check an input, toggle the input on and off while watching the control box indicator lamps. The corresponding lamp should toggle on and off in sync with the input.

6.1 Getting Technical Support by Phone or Fax

If you need technical assistance, contact us by phone or fax and please have the following information available:

1) Customer Name, Address, Phone Number, Fax Number
2) System Control Box Model Number
3) System Control Box Serial Number
4) Description of the problem.

The serial number and model number of the system control box can be located on the right hand side of the box. It is imprinted on a SILVER ID TAG.

American LED-gible Inc.
(614) 851-1100
September 2004
Model # AF-2450-057
Serial # SO-6845-001

American LED-gible technical support may be reached at:

Phone: (614) 851-1100
Fax: (614) 851-1121
E-mail: ledgible@ledgible.com

7.0 Limited Warranty

We warrant to you that your AMERICAN LED-gible BRAND MARQUEE, when purchased by you, will be free from defects in material and workmanship, under normal use, for one year from date of delivery. If your LED-GIBLE BRAND MARQUEE should prove to be defective within the warranty period, we will repair it (or, if we think necessary, replace it) without charge to you.

To obtain service, please call our Customer Service Department at 1-614-851-1100 or write to:

AMERICAN LED-gible Inc.
1776 LONE EAGLE STREET
COLUMBUS, OHIO 43228

We will furnish you with shipping instructions. This warranty covers merchandise returned to American LED-gible (shipped prepaid) for repair, not in plant repairs. Should you need an in plant repair at your facility, American LED-gible will schedule a trip. Rates are per diem, plus travel expenses.

ALI shall have the right of final determination as to the existence and cause of the defect. This warranty expressly excludes any defects or damages caused by accessories, replacement parts, or repair service, other than those which have been authorized by ALI. This warranty does not cover any damage caused by accident, misuse, shipment, or other than ordinary use.

This warranty excludes all incidental or consequential damages. Some states do not allow the exclusion of, or limitation of, incidental or consequential damages, so the foregoing exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. This warranty is in lieu of any other warranty, express, written, implied, or statutory, and no agreement extending or modifying it will be binding upon ALI, unless in writing and signed by duly authorized officer.

If your AMERICAN LED-gible MARQUEE is outside the warranty period, please call our Customer Service Department as above. After you return the unit to American LED-gible, we will estimate the repair charges, and contact you so a purchase order can be issued. Again, should you require in-house repair of your marquees, ALI rates are per diem, plus travel expenses. Please make sure to call, so a trip can be scheduled if this option is preferred.

LIMITATION OF LIABILITY:

If this product is not in good working order as warranted above, your sole remedy shall be repair or replacement as provided above. In no event will ALI be liable for special, indirect, or consequential damages, or any damages whatsoever resulting from loss of use, data, or profits arising out of, or in connection with this contract or the use or performance of ALI products, whether in an action of contract or tort, including negligence. ALI's liability for damage to property shall be limited to the cost of the product sold to the buyer.

8.0 ASCII Chart

ASCII CHARACTER	Hexadecimal Code	Decimal Code
CTRL-A	01h	1
CTRL-B	02h	2
CTRL-C	03h	3
CTRL-D	04h	4
CTRL-E	05h	5
CTRL-F	06h	6
CTRL-G	07h	7
CTRL-H	08h	8
CTRL-I	09h	9
CTRL-J	0Ah	10
CTRL-K	0Bh	11
CTRL-L	0Ch	12
CTRL-M	0Dh	13
CTRL-N	0Eh	14
CTRL-O	0Fh	15
CTRL-P	10h	16
CTRL-Q	11h	17
CTRL-R	12h	18
CTRL-S	13h	19
CTRL-T	14h	20
CTRL-U	15h	21
CTRL-V	16h	22
CTRL-W	17h	23
CTRL-X	18h	24
CTRL-Y	19h	25
CTRL-Z	1Ah	26
CTRL-[	1Bh	27
CTRL-\	1Ch	28
CTRL-]	1Dh	29
CTRL-^	1Eh	30
CTRL-_	1Fh	31
SPACE	20h	32

ASCII CHARACTER	Hexadecimal Code	Decimal Code
!	21h	33
"	22h	34
#	23h	35
$	24h	36
%	25h	37
&	26h	38
'	27h	39
(	28h	40
)	29h	41
*	2Ah	42
+	2Bh	43
,	2Ch	44
-	2Dh	45
.	2Eh	46
/	2Fh	47
0	30h	48
1	31h	49
2	32h	50
3	33h	51
4	34h	52
5	35h	53
6	36h	54
7	37h	55
8	38h	56
9	39h	57
:	3Ah	58
;	3Bh	59
<	3Ch	60
=	3Dh	61
>	3Eh	62
?	3Fh	63
@	40h	64

ASCII CHARACTER	Hexadecimal Code	Decimal Code
A	41h	65
B	42h	66
C	43h	67
D	44h	68
E	45h	69
F	46h	70
G	47h	71
H	48h	72
I	49h	73
J	4Ah	74
K	4Bh	75
L	4Ch	76
M	4Dh	77
N	4Eh	78
O	4Fh	79
P	50h	80
Q	51h	81
R	52h	82
S	53h	83
T	54h	84
U	55h	85
V	56h	86
W	57h	87
X	58h	88
Y	59h	89
Z	5Ah	90
[	5Bh	91
\	5Ch	92
]	5Dh	93
^	5Eh	94
_	5Fh	95
'	60h	96

ASCII CHARACTER	Hexadecimal Code	Decimal Code
a	61h	97
b	62h	98
c	63h	99
d	64h	100
e	65h	101
f	66h	102
g	67h	103
h	68h	104
i	69h	105
j	6Ah	106
k	6Bh	107
l	6Ch	108
m	6Dh	109
n	6Eh	110
o	6Fh	111
p	70h	112
q	71h	113
r	72h	114
s	73h	115
t	74h	116
u	75h	117
v	76h	118
w	77h	119
x	78h	120
y	79h	121
z	7Ah	122
{	7Bh	123
|	7Ch	124
}	7Dh	125
~	7Eh	126
DELETE	7Fh	127

9.0 Connection Labels

NEUT	NEUT	DONE	PDONE	GREEN	RED	OVER	POVER	SPARE	SPARE
NEUT	NEUT	DONE	PDONE	GREEN	RED	OVER	POVER	SPARE	SPARE
NEUT	NEUT	DONE	PDONE	GREEN	RED	OVER	POVER	SPARE	SPARE
NEUT	NEUT	DONE	PDONE	GREEN	RED	OVER	POVER	SPARE	SPARE

24GND	24GND	HOLD	RESET	CNTUP	CNTUP	CNTDW	CNTDW	DOWN	CLOCK
24GND	24GND	HOLD	RESET	CNTUP	CNTUP	CNTDW	CNTDW	DOWN	CLOCK
24GND	24GND	HOLD	RESET	CNTUP	CNTUP	CNTDW	CNTDW	DOWN	CLOCK
24GND	24GND	HOLD	RESET	CNTUP	CNTUP	CNTDW	CNTDW	DOWN	CLOCK

24GND	24GND	SCRAP	SCRAP	SPARE	SPARE	SPARE	SPARE	SPARE	KEYDIS
24GND	24GND	SCRAP	SCRAP	SPARE	SPARE	SPARE	SPARE	SPARE	KEYDIS
24GND	24GND	SCRAP	SCRAP	SPARE	SPARE	SPARE	SPARE	SPARE	KEYDIS
24GND	24GND	SCRAP	SCRAP	SPARE	SPARE	SPARE	SPARE	SPARE	KEYDIS