

# WCC III

## 18. SAT 3P (Pulsemeter) Controller Manual

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### SECTION 18: SAT 3P (PULSEMETER) CONTROLLER MANUAL (SS5013)

Each SAT III controller has a single general purpose AIN 1 input that is an Analog Input / high speed binary capture input which can also be used as a pulse meter input. The SAT III controller can only interface to 1 pulse meter.

The SAT 3P controller is in the simplest terms a stripped down SAT III controller. The SAT 3P controller has no binary logic inputs, no relay outputs, no analog inputs, no analog outputs, and no HSS expansion port. The SAT 3P controller has eight high speed binary capture inputs used for pulse meter type inputs.

Why would you want to purchase a SAT 3P controller? Cost and labor are the major factors. To do tenant sub-metering for 16 tenants, you would normally need to buy 16 SAT III controllers. This would be a fairly high and costly expenditure. The same 16 tenant sub-metering can now be accomplished by using two SAT 3P controllers. Also, wiring is an issue. It is easier to wire 16 pulse meter outputs to two SAT 3P controllers than it is to wire to 16 SAT III controllers that could be scattered throughout the building. The SAT 3P controllers should ideally be located next to the pulse meters. This is so that the binary outputs from the pulse meters can readily and easily be connected to the inputs of the SAT 3P controller.

The SAT 3P controller is used to interface up to 8 pulse meters per SAT 3P controller. The SAT 3P simulates 8 SAT III satellites on the WCC III communications loop. The one and only input that is used per simulated satellite is AIN1. This AIN1 input is no longer a general purpose analog input on the SAT 3P controller. This AIN1 input is a specialized high speed capture binary input, and is designed to detect pulse type inputs. All other satellite inputs and outputs are non-functional on these 8 simulated satellites. The Trendlog capabilities are still functional on these 8 simulated satellites.

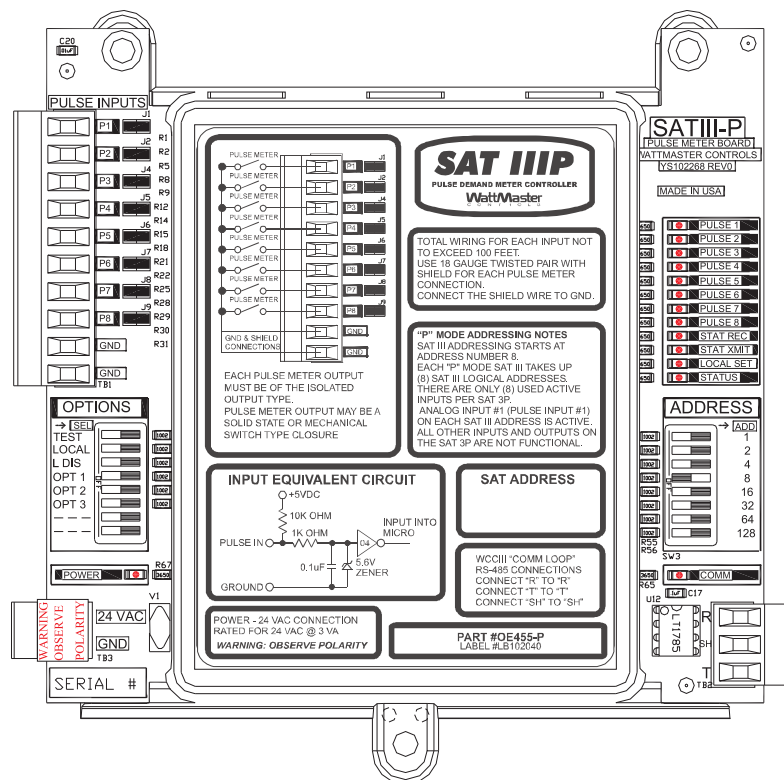


Figure 18-1: SAT 3P Controller

## 18. SAT 3P INSTALLATION GUIDE

### SAT 3P Pulse Input and Components

When used in conjunction with the WCC III system, the SAT III controllers and SAT 3P controllers are capable of recording energy demand, energy consumption, as well as sub-metering, and then automated logging of tenant power usage. Sophisticated turning OFF of high usage energy equipment when there is high energy peak demand time is also possible with what is called “Shed and Restore Program” via the WCC III system. This can be accomplished by using a pulse meter on the building incoming power that outputs a binary contact closure to a pulse meter input on a SAT III or SAT 3P controller. Then, by making global analog and/or global binary determinations, make an intelligent decision as to what equipment to keep on and what equipment to turn off.

The binary outputs from the pulse meter(s) must be of the isolated output type. They can be of the optically coupled open-collector current sink transistor output type or an actual dry contact type of output. Please consult with WattMaster Controls if you have any questions at all about the type of connection from the Pulse Meter to the SAT 3P controller(s).

The binary input circuit equivalent of the SAT 3P controller is summarized in Figure 18-2:

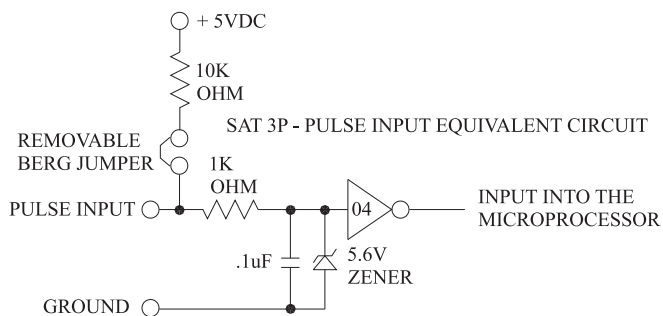


Figure 18-2: Schematic showing the SAT 3P Pulse Input equivalent circuit multiplied times eight circuits

The two position Removable Berg Jumper on each of the eight Pulse Inputs on the SAT 3P controller are normally connected. These Removable Berg Jumpers connect a +5 volt DC pull up via a 10K ohm current limit resistor to each of the eight Pulse Inputs on the SAT 3P controller. These Removable Berg Jumpers are to be removed only if an external voltage source is to be used with the pulse meter output.

WattMaster Controls-approved pulse meter with isolated outputs are E-Mon D-Mon Class 2000 Three-Phase kWh or kWh/Demand meter with the optional E-Mon D-Mon P2 Pulser output module.

The E-Mon D-Mon P2 Pulser output module is an optically coupler interface device that allows the Class 2000 kWh or kWh/Demand meter to be connected to an energy/building management system (EMS) for the purpose of data-gathering and/or load control. The pulse width and value are selected using the 2 DIP switches and can be tailored to fit your specific requirements in the field. A modular plug connects the P2 Pulser output module to the E-Mon D-Mon meter. A two position screw terminal block provides an easy connection to the EMS (SAT 3P controller). An LED on the P2 Pulser output module shows the rate and duration of the pulse output that is going to the EMS (SAT 3P Controller). The P2 Pulser output module has an output operation of 4.5 to 28 volts DC that is to be supplied by the EMS. (SAT 3P Controller)

Please refer to **Figure 18-3** for referencing the following components of the SAT 3P controller:

#### Communications Terminal Block (Labeled TB2)

The SAT 3P connects to the WCC III system the same way as other SAT III, and SAT 3C/D,F controllers do via a proprietary RS-485 network. The physical network layer consists of a two-wire twisted pair with shield wire. WattMaster Controls can provide a detailed specification for this wire as well as provide 500' or 1000' spools of this wire. All terminated wiring is by three position unpluggable terminal blocks or single unpluggable ¼ inch spade connections. When terminating wire, connect “R” to “R”, “T” to “T”, and “SHLD” TO “SH” throughout the whole WCC III system.

#### Comm LED

This LED is tied to the “DIR” line of the RS-485 driver chip (LT1785 – WM Part # ID001785). It will slightly blink on receipt of a communications packet.

#### Power In Terminal Block (Labeled TB3)

Connect 24VAC and Ground from a transformer. **Warning: Observe Polarity.** We recommend using a separate transformer, but as long as the same polarity is used for 24VAC and GND on all Satellite connections, then multiple Satellite controllers can be powered off of a single transformer, as long as you do not exceed the VA rating of the transformer. Use a self-fusing transformer or use a suitable sized fuse for your transformer that accounts for the total VA draw. The Sat 3P draws 3 VA, SAT III draws 15VA, and the SAT 3C/D/F draws 10VA.

#### Power LED

This LED is tied to the +5 Volt DC power supply of the SAT 3P controller. This LED should always be “ON” and never blink.

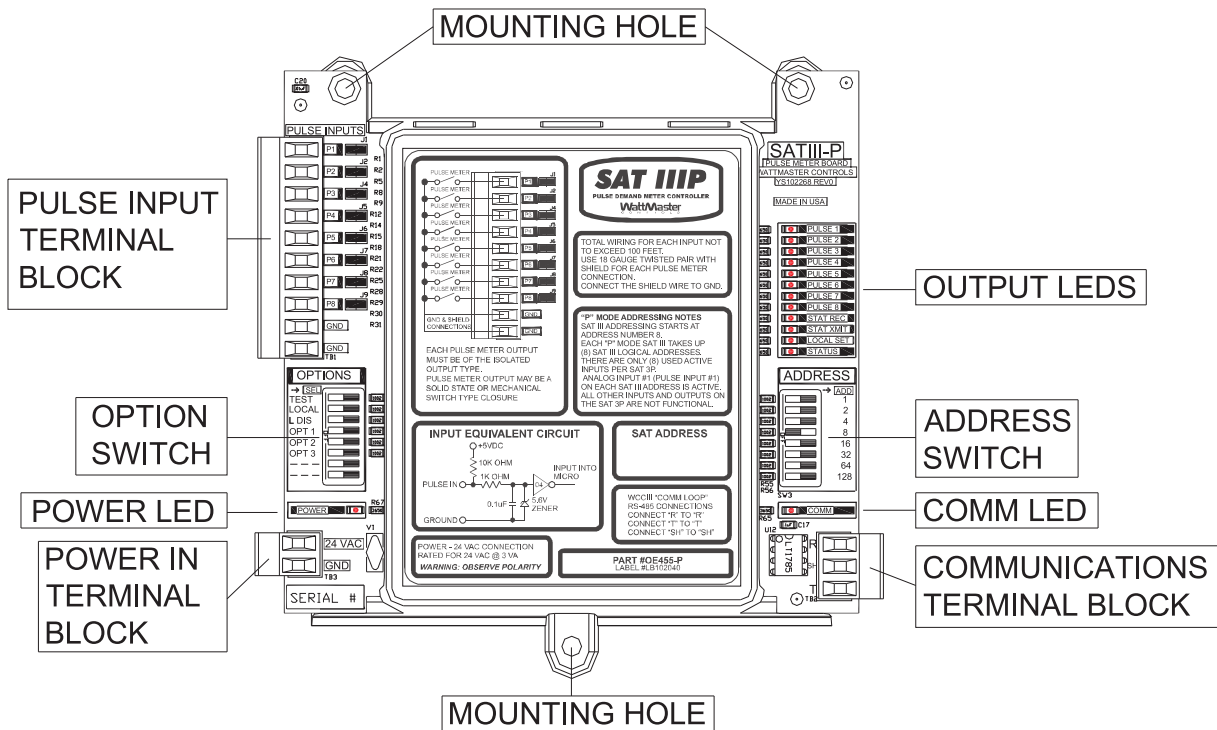


Figure 18-3: SAT 3P Points of Interest

Pulse Input Terminal Block (LABELED TB1)

This 10-position terminal block is connected to the Pulse meter(s) output. There are eight input connections and two ground terminals provided for ground connections. See **Figure 18-5**.

Output LEDs

PULSE 1 to PULSE 8 LEDs. These LEDs are not physically connected to the actual high speed binary capture inputs. They are software controlled outputs from the microprocessor that is on the SAT 3P controller. This enables true output status to be displayed of the actual pulse inputs.

STAT LEDs

There are two STAT LEDs—STAT REC and STAT XMIT. Whenever the microprocessor transmits a communications packet, the STAT XMIT LED will be “ON”. Whenever the microprocessor receives a communications packet, the STAT REC LED will be “ON”. The STATUS LED blinks out a heart beat status of the SAT 3P controller.

LOCAL SET LED

This LED is normally off, but when the SAT 3P is not communicating to the WCC III – MCD, this LED will be “ON” solid.

Option Switches

TEST Switch—When this switch is “ON,” then the SAT 3P will operate to any input condition that has the word “TEST” programmed into the setpoint.

LOCAL Switch—When this switch is “ON,” then the SAT 3P operates to the LOCAL SET conditions. Also the SAT 3P controller will operate in the LOCAL SET conditions when it has lost communications to the rest of the WCC III communications loop. This Local set condition should be indicated by the LOCAL SET LED being “ON”.

L DIS Switch—When this switch is “ON,” then the SAT 3P will not operate to the LOCAL SET conditions. It should control to setpoints that are based on the “ON” schedule.

OPT 1, OPT 2, OPT 3 switches—These three switches are not used at this time.

Mounting Holes

Use the three supplied sheet metal screws to mount the SAT 3P controller in a suitable enclosure. You must use all three screws to mount the SAT 3P controller.

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## SAT 3P Addressing

### Address Switch

An eight position Dip Switch is provided for Satellite addressing. Each SAT 3 type controller must have its own unique address. There are 256 possible addresses that can be set with this address switch. The WCC III system is limited to 239 Satellite addresses maximum. The SAT 3P addressing starts at address # 8 and ends at address # 232. Each SAT 3P controller takes up (uses) 8 physical addresses. **Figure 18-4** shows all of the possible addresses for a SAT 3P controller.

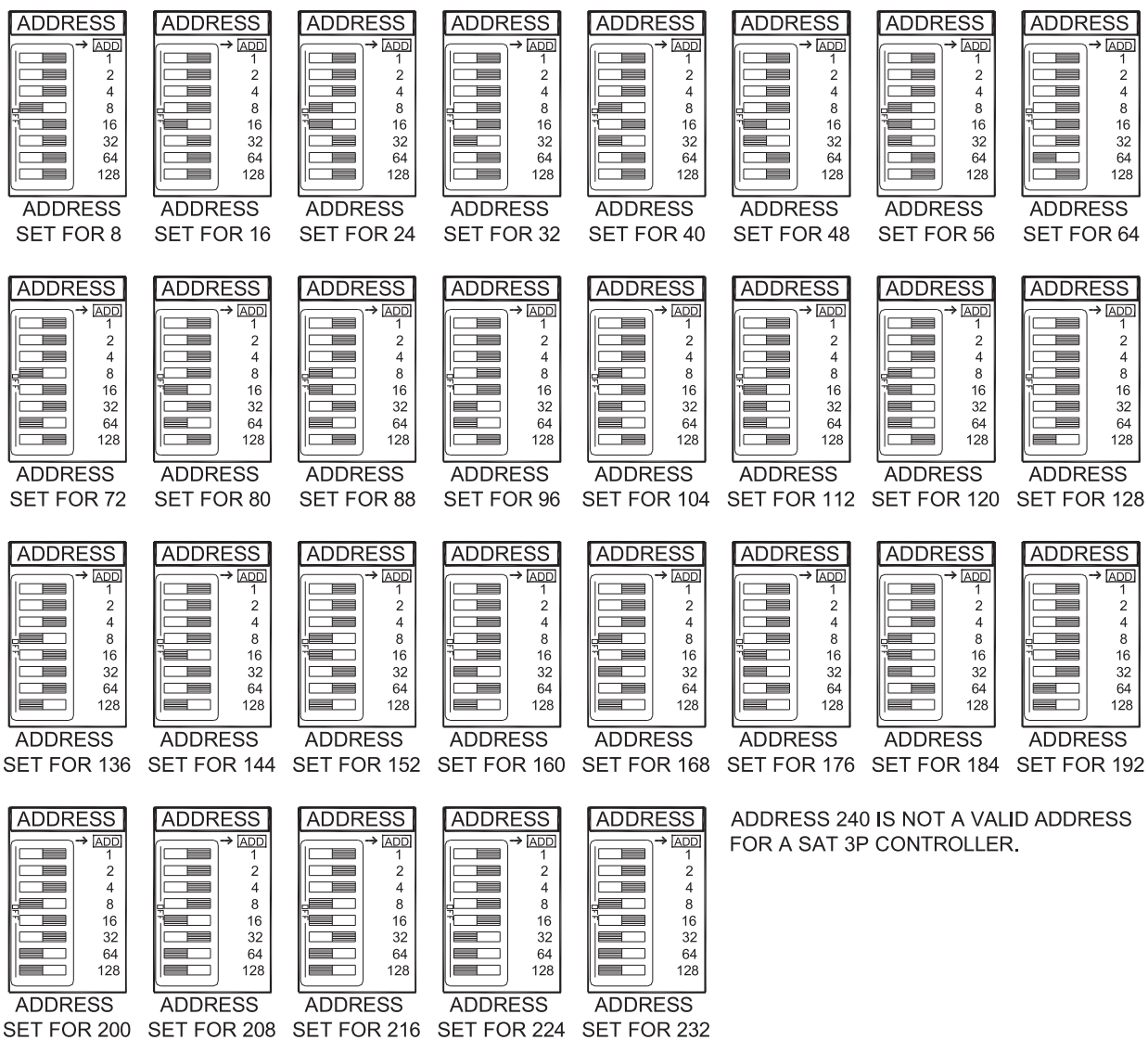


Figure 18-4: Possible Addresses for SAT 3P Controller

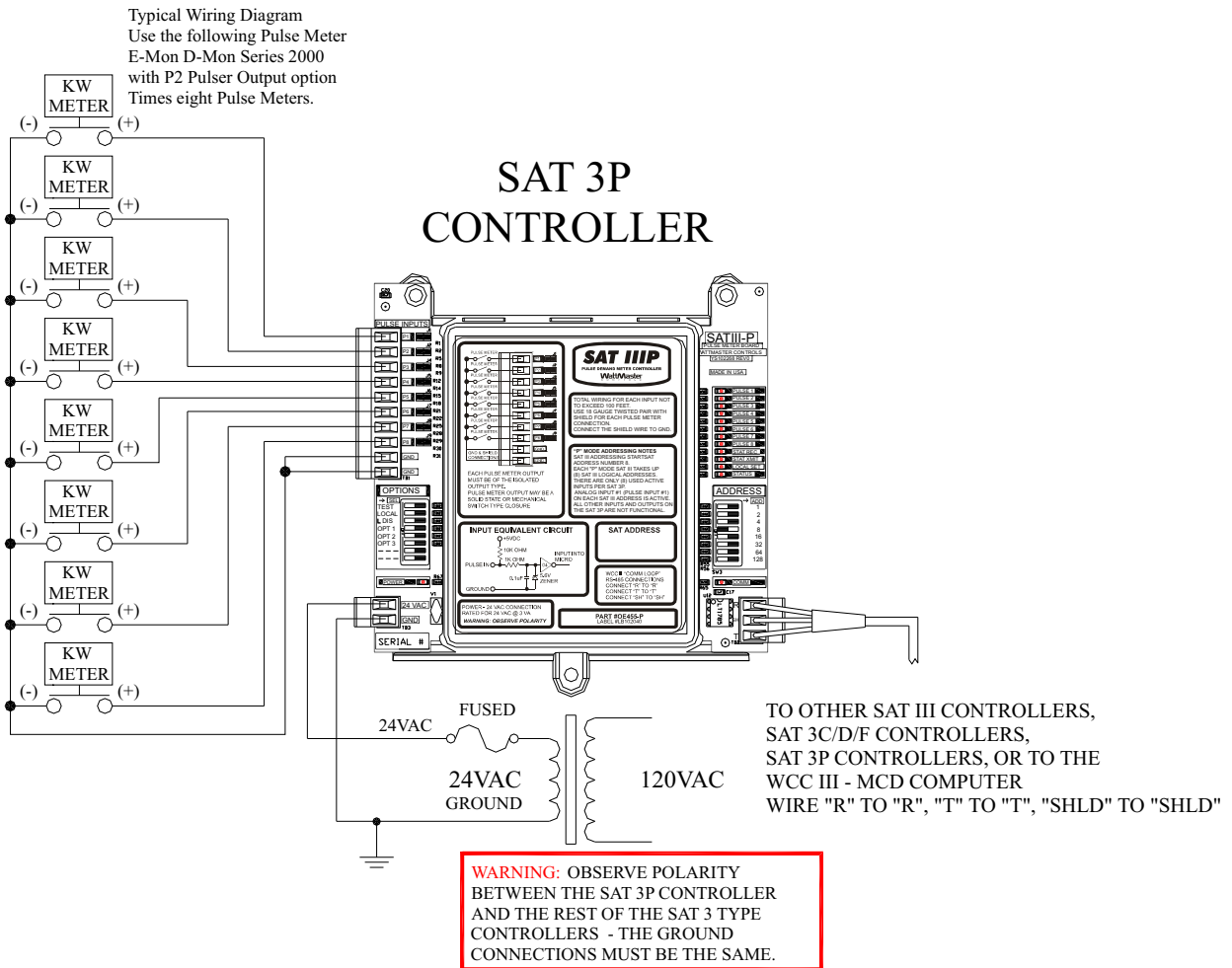


Figure 18-5: Basic SAT 3P Controller Wiring Diagram

Basic Wiring Instructions

Use 16 or 18 gauge stranded wire to wire from the KW pulse meter to the SAT 3P controller. Wiring from the transformer to the SAT 3P should also be 16 or 18 gauge stranded wire. Warning: Observe Polarity on all power wiring. All wiring is to be done in accordance with all national, state, and local electrical codes.

Basic Communications Wiring Instructions

Use 18 or 20 gauge - 2 conductor twisted pair with shield. This wire should also be Plenum Rated WattMaster Controls stocks Plenum Rated - 2 conductor twisted pair with shield wire. WattMaster Controls part #WR-NL-WG-18 is for a 500 foot spool and part #WR-LL-WG-18 for the 1000 foot spool. No more

than two conductors are allowed per contact of the three position communications terminal block. No wire nuts are to be used on the Communications wiring. WattMaster Controls also has a Power & Switchable Communications board available for purchase. To connect one Satellite controller to another Satellite controller you must wire the "R", "T", and "SHLD" or "SH" connections as follows: Wire all of the different satellites "R" connections to "R", wire all of the different satellites "T" connections to "T", and wire all of the different satellites "SHLD" or "SH" connections to "SH" or "SHLD".

The transformer used for powering the SAT 3P controller needs to be of the self fusing type or it needs to have an appropriately sized fuse on the secondary side of the transformer (24VAC side).

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## SAT 3P Typical Wiring

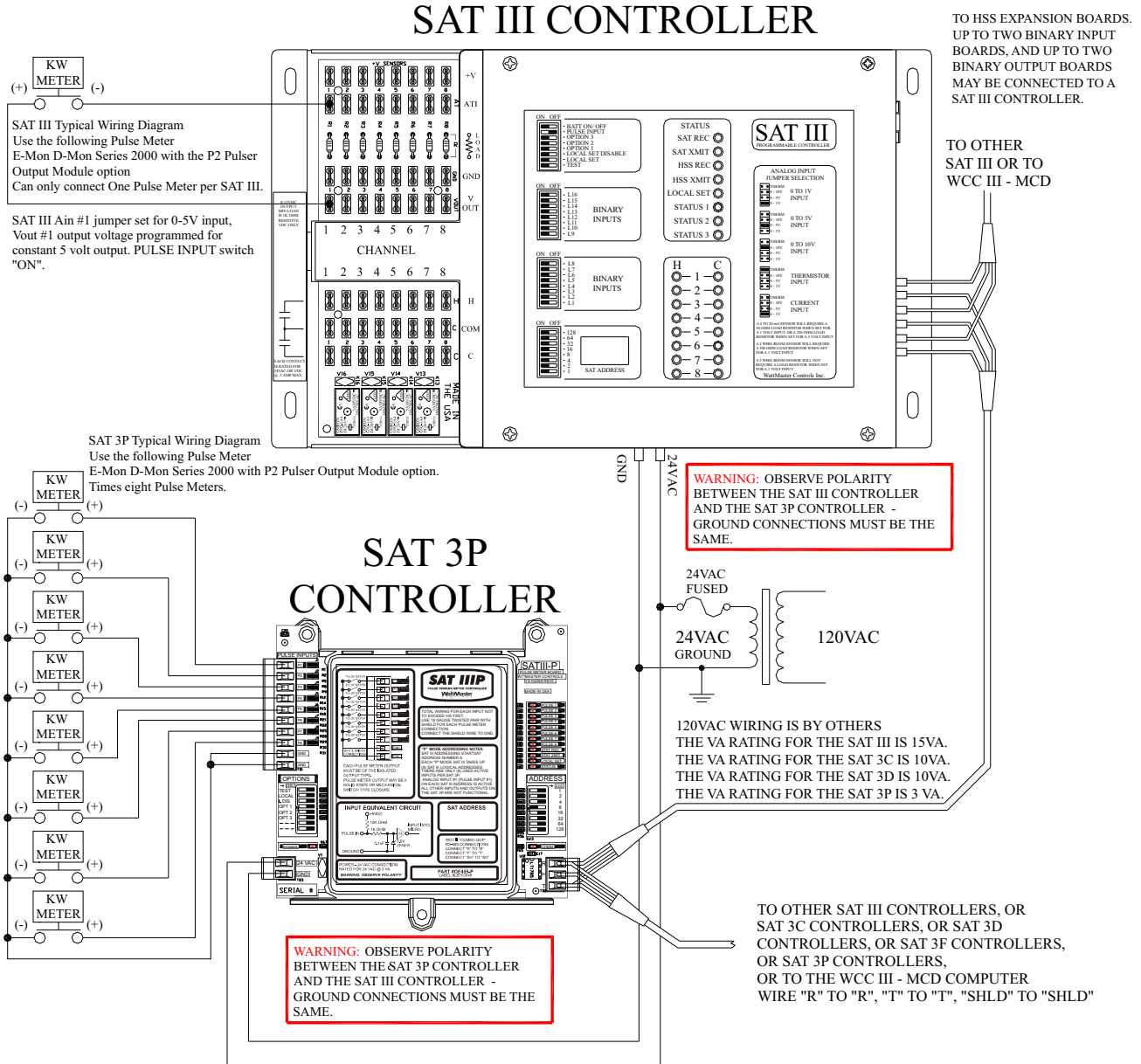


Figure 18-5: SAT 3P Controller Typical Wiring Diagram

When sharing a common transformer to power other Satellite Controllers, the transformer used for powering multiple SAT III, SAT 3C, SAT 3D, SAT 3F, or SAT 3P controllers needs to be of the self fusing type, or the transformer needs to have an appropriately sized fuse on the secondary side of the transformer (on the 24VAC side). VA ratings for the various Satellites that are connected to the satellite controllers must be accounted for and must be added up, and an appropriate sized transformer must be used, along with an appropriate sized fuse on the secondary side of the transformer that must also be used. All wiring is to be done in accordance with all national, state, and local electrical codes.

The transformer used for powering the SAT 3P controller needs to be of the self fusing type or it needs to have an appropriately sized fuse on the secondary side of the transformer (24VAC Side).

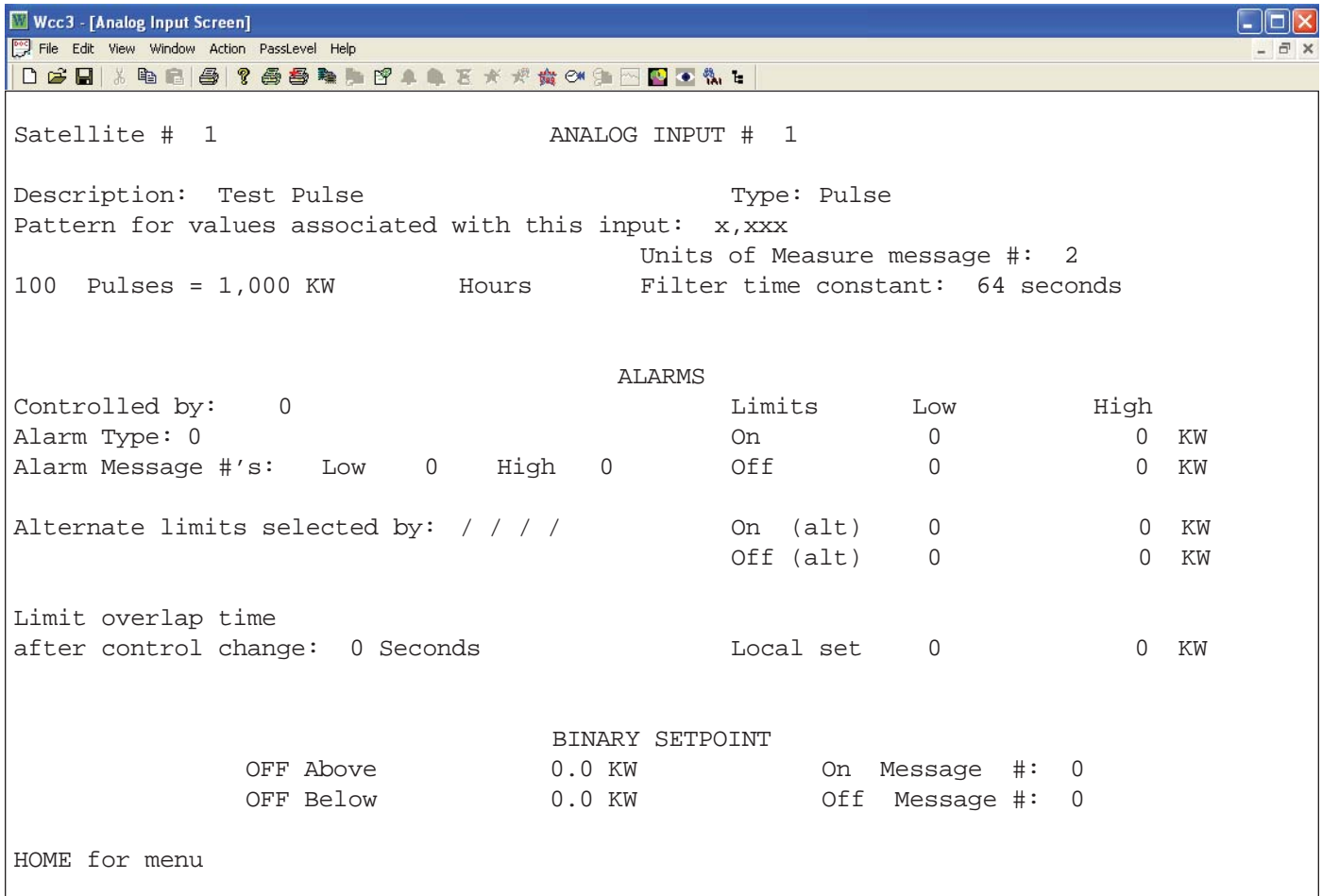


Figure 18-6: Analog Input Screen

Satellite # \_\_\_\_\_

Specifies the number of the satellite which you are currently editing. If you would like to edit a different satellite, use the arrow keys to move the cursor to this field, type in the desired satellite number, and press <Enter>.

Analog Input # \_\_\_\_\_

This “field” actually contains two separate fields. The first field specifies the point “type” (i.e., analog input, control output, analog output, etc.) and displays the current type in textual form. Because this is a “choice” field, the list of available choices will be displayed at the bottom of the screen:

```
<ANALOG INPUT, CONTROL OUTPUT, ANALOG OUTPUT,
TREND LOGGING, LOGIC SWITCH, BINARY OUTPUT>
```

You may make your selection by pressing the <space bar> until the desired choice appears and then pressing <Enter>. (If you select a point type that is different than that currently being displayed, the screen will be rewritten with the appropriate screen and data.)

Additionally, this field specifies the point number to edit. For the *Analog Input Screen*, this number can range from one to eight, corresponding from A1 to A8, respectively. If you would like to edit a different point, move the cursor to this field by using the arrow keys, enter the desired point number, and press <Enter>.

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NOTE: When using the SAT3P, only Analog Input #1 will be used per simulated satellite (there are 8 simulated satellites per SAT3P). All other satellite inputs and outputs are non-functional on these 8 simulated satellites. The trendlog capabilities are still functional on these 8 simulated satellites.

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Description:

A short message is entered here which is displayed on *Summary Screens* to help you remember points within the system. You may enter up to ten characters (control codes, ALT codes, and the double quote character are not allowed).

## Analog Input Screen

Type:

This field is automatically filled in by the system. On the SAT 3P, it will always be "PULSE".

Pattern for Values Associated With This Input:

Specifies where you would like the decimal point to appear in the value displayed by the system. Because this is a "choice" field, a list of available choices will be displayed at the bottom of the screen:

< x,xxx , xxx.x , xx.xx , x.xxx >

You may make your selection by pressing the <space bar> until the desired data pattern has been selected and then pressing <Enter>.

Units of Measure      Message #: \_\_\_\_

A number is entered here that references a message on the *On/Off Units Messages Screen*. For example, if units-of-measure message #4 is "KW" entering "4" will cause "KW" to be displayed as the units-of-measure for the analog input.

\_\_\_\_\_ Pulses = \_\_\_\_\_ Hours

Specifies the calibration information for the pulse meter. The first input is a "choice" field, and therefore a list of available choices will be displayed at the bottom of the screen.

< 100, 1000 >

The second input is used to "scale" or "calibrate" the particular sensor that is being used. For example, consider a pulse meter which measures the kwh of a building. Electrical meters are basically a small motor whose speed is proportional to power being used. Let's consider a meter where one revolution equals one kwh, and the meter sends 5 pulses to the satellite controller for every 6 revolutions. Therefore, we would enter "100 Pulses = 120 kwh hours." (NOTE: maximum pulse rate allowed = 4 pulses per second.)

5 pulses = 6 revolutions  
1 revolution = 1 kwh  
5 pulses = 6 kwh  
100 pulses = 120 kwh

Filter Time Constant: \_\_\_\_ Seconds

Specifies the sampling rate of the analog input. This is used by the satellites to "filter" (or smooth) the analog input signal. This can be used on inputs that "jump around" to reduce sporadic load control. Because this is a "choice" field, the list of available choices will be displayed at the bottom of the screen:

< 0, 1, 2, 4, 8, 16, 32, 64 >

You may make your selection by pressing the <space bar> until the desired filter time constant has been selected and then pressing <Enter>.

### -----ALARMS-----

Controlled by:

Specifies the binary value that selects the ON or OFF alarm limits. When this value is OFF, the OFF alarm limits are selected; when it is ON, the ON alarm limits are selected.

Alarm Type:

Specifies the priority (or "importance") level for any alarms generated by this input. Alarm types range from one (highest priority) to eight (lowest priority). The system displays and e-mails higher priority alarms first. (The first five alarm priorities (1-5) have e-mail-out-on-alarm capabilities.)

Alarm Message # Low: \_\_\_\_ High: \_\_\_\_

Specifies a pair of message numbers, one for LOW alarms and the second for any HIGH alarms. These numbers are used by the system to reference a message which is entered on the *Alarm Message Screen*.

Analog Input Screen

Alternate Limits Selected By:

Specifies the point that initiates the Alternate mode. When this address is zero (or OFF), the Normal alarm limits are selected; when it is one (or ON), the Alternate alarm limits are selected.

Limits	Low	High	
On	_____	_____	° F
Off	_____	_____	° F
On (alt)	_____	_____	° F
Off (alt)	_____	_____	° F
Local Set	_____	_____	° F

This group of inputs specifies the alarm limits for the “Normal,” “Alternate,” and “Local Set” modes. Each mode has a LOW and HIGH limit. When the value of the analog input goes out of these limits, an alarm is generated, and the alarm will automatically display and e-mail out.

There are two fields on this screen that determine which set of limits are active—the status of the “Controlled by” field and the status of the “Alternate Limits selected by” field. When the value that has been input in the “Controlled by” field is ON, either the “On” limits or the “On (Alt)” limits are active depending on the status of the value input in the “Alternate Limits selected by” field. If the value in the “Alternate” field is On, the “On (Alt)” limits are used, and when the “Alternate” value is OFF, the “On” limits are used.

Controlled by:	Alternate Limits Selected by:	Active Alarm Limits:
On	Off	On
On	On	On (Alt)
Off	Off	Off
Off	On	Off (Alt)

The local set alarm limits become active if the MCD quits communicating with the satellite controller. After communications are re-established, any alarms that occurred while the satellite was in local set will be reported.

Limit overlap time after control change:

This specifies the amount of time the WCC software will wait after a control change (i.e., on/off schedule, alternate mode, local set mode) before deciding to generate an alarm. The first input is a user-entered number from 1 to 60, and the second input is either seconds or minutes. This second input is a “choice” field; the list of available choices will be displayed at the bottom of the screen:

<Seconds, Minutes>

You may make your selection by pressing the <space bar> until the desired choice is selected and then pressing <Enter>.

----- BINARY SETPOINTS -----

\_\_\_\_Above:\_\_\_\_  
 \_\_\_\_Below:\_\_\_\_

These inputs are used to convert the analog signal to a binary (On/Off) signal. The value that is going ON and OFF is a software point referred to as a comparator. Each analog input has a comparator associated with it named “Cn.” The comparator for analog input #1 is “C1,” analog input number 2 is “C2,” and so on. The status of the comparator can be seen on the *Analog Input Summary Screen*.

When the user has selected:	The value of the comparator is:
OFF Above & OFF Below:	OFF when the Analog Input value is greater than the ABOVE setpoint or less than the BELOW setpoint, and ON when the Analog Input value is equal to either one or between the two setpoints.
OFF Above & ON Below:	OFF when the Analog Input value is greater than or equal to the ABOVE setpoint or until the Analog Input value becomes less than the BELOW setpoint, and ON when the Analog Input value is less than or equal to BELOW setpoint or until the Analog Input value becomes greater than the ABOVE setpoint.
ON Above & OFF Below:	OFF when the Analog Input value is less than or equal to the BELOW setpoint or until the Analog Input value becomes greater than the ABOVE setpoint, and ON when the Analog Input value is greater than or equal to the ABOVE setpoint or until the Analog Input value becomes less than the BELOW setpoint.
ON Above & ON Below:	OFF when the Analog input value is equal to either one or between the two setpoints, and ON when the Analog Input value is greater than the ABOVE setpoint or less than the BELOW setpoint.

Because this is a “choice” field, a list of available choices will be displayed at the bottom of the screen:

<ON, OFF>

You may make your selection by pressing the <space bar> until the desired choice is selected and then pressing <Enter>.

On Message #:  
 Off Message #:

Specifies a pair of message numbers, the first for the ON state and the second for the OFF state of the comparator. These numbers are used by the system to reference a message on the *ON/OFF Units Message Screen*. For example, the comparator might be set up to come on when the outside air temperature is below 55 °F for economizer operation. Set up the *On/Off Message Screen* so that message #3 is “ECON” and message #4 is “REFRIG.” The “On Message” number would be “3” (ECON), and the “OFF Message” number would be “4” (REFRIG).

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## Energy Consumption Screen

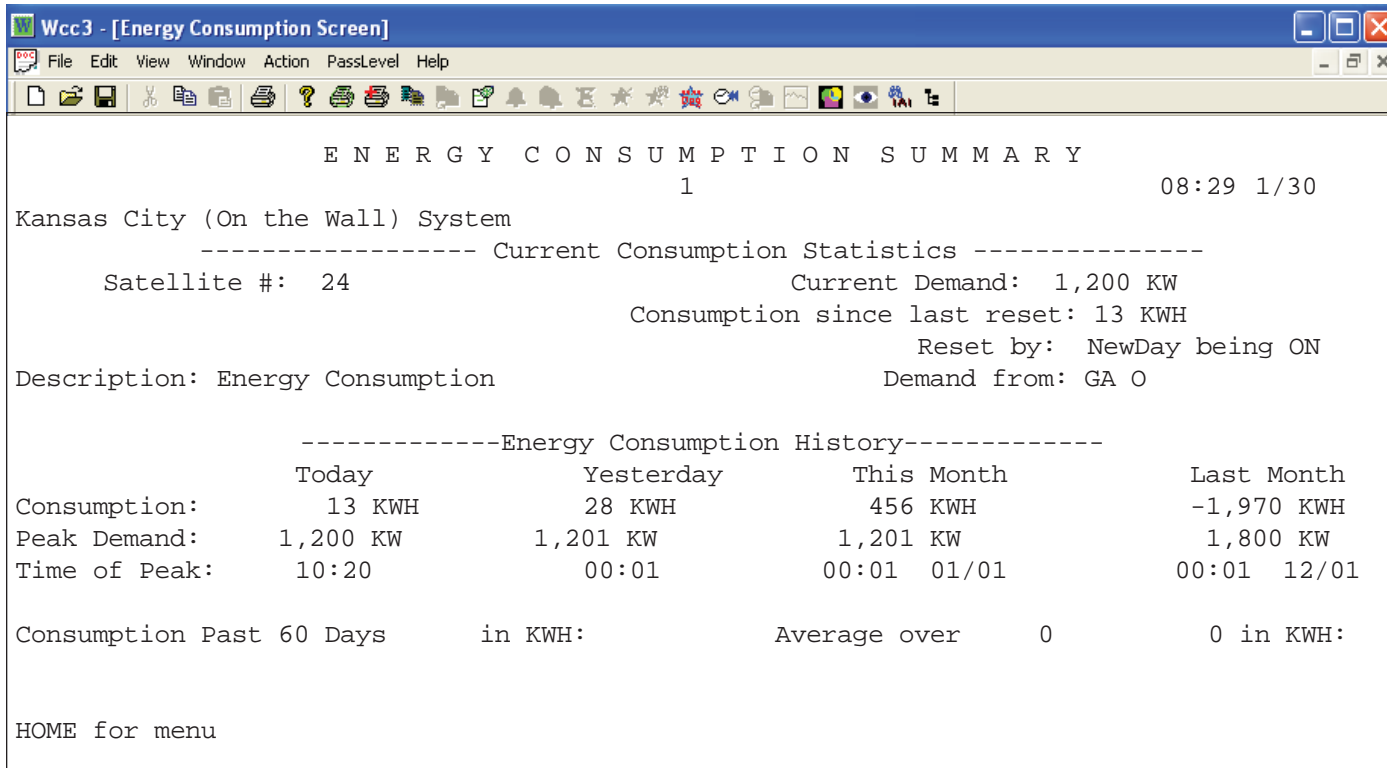


Figure 18-6: Energy Consumption Screen

The WCC III system has 50 *Energy Consumption Screens*. The number directly under the ENERGY CONSUMPTION SUMMARY title is the number of the screen. To change the number, move the cursor to this field, enter the number you would like, and then press <Enter>.

Satellite #: 1

Enter the number of the satellite controller which has the pulse type kw meter connected to it.

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NOTE: The pulse meter must be connected to the analog input #1 on the satellite controller, and the pulse switch on the front of the satellite controller must be in the "On" position and a 5 VDC signal (from the Satellite's V-Out) must be connected to one side of the pulse meter contact.

---

Current Demand and Consumption Since Last Reset:

The current demand and the current consumption since last reset are automatically displayed here. To reset the consumption, select <Action> from the Top Menu Bar and then select <Reset>.

The following units may be selected for consumption by placing the cursor over the units for the "Consumption since last reset," pressing the <space bar> until the desired units appear, and then pressing <Enter>.

- KWH = 1 KWH
- DKH = 10 KWH
- HKH = 100 KWH
- MWH = 1,000 KWH
- DMH = 10,000 KWH
- HMH = 100,000 KWH
- GWH = 1,000,000 KWH
- DGW = 10,000,000 KWH

5428 KWH will appear as 543 DKH  
5428 KWH will appear as 54 HKH, etc.

## Energy Consumption Screen

The units selected will appear for the consumption since last reset and also for the monthly consumption. The maximum value of 9999 for monthly consumption should be taken into consideration when selecting units. The significant figures will be adjusted as different choices are selected. For example, if you have a present value of 5428 KWH, and you change the units from KWH to HKH, 54 HKH will appear on the screen. If you then change back to KWH, 5400 KWH will appear.

Reset by \_\_\_\_\_ being \_\_\_\_\_:

Specifies the [binary] point address that will be used to reset (or clear) the current demand and the consumption since last reset. The first field specifies the point address (see section 1 for additional information), and the second specifies the state or condition that the point address needs to be in to clear the data. Because this second field is a “choice” field, the list of available choices will be displayed at the bottom of the screen.

<OFF, ON>

You may make your selection by pressing the <space bar> until the desired choice is selected and then pressing <Enter>.

#### Description

Specifies a short textual message to aid you in remembering points within the system. You may enter up to eighteen characters (control codes, ALT codes, and the double quote character are not allowed).

Demand From: GA 0

If you would like to average the kwh of the building using the sliding window feature of the analog globals, enter the number of the analog global which has the building kwh. If you want to read the kwh from the satellite controller directly, enter GA0.

#### Energy Consumption History

The system will automatically show what the consumption (kwh) and demand (KW) is for today, yesterday, this month, and last month. The system will also show the time and date when the peak occurred.

<Consumption> <Demand>

You may select either Consumption or Demand by placing the cursor in this field, pressing the <space bar> until the desired word appears and then pressing <Enter>.

<Past 60 Days> <Past 12 Months>

You may also choose to display the past 60 days of data or the past 12 months by pressing the <space bar> until the desired choice appears and then pressing <Enter>.

You may move the cursor down into the consumption or demand table and manually enter the KWH demand for certain days or months.

