

ADVANCED ENERGY MANAGEMENT UTILIZING TOU-BASED CONTROL STRATEGY

An Application Note



General

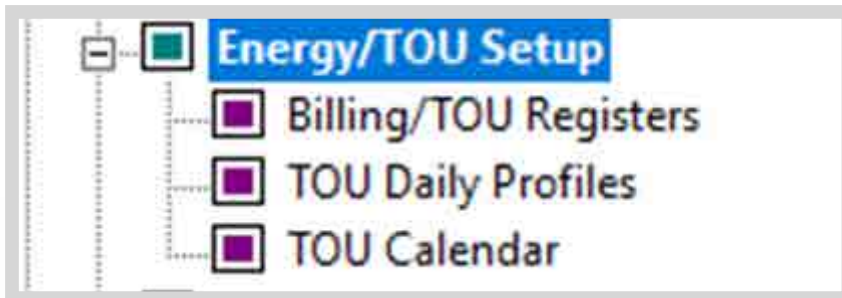
In the dynamic landscape of diverse energy sources and tariffs, SATEC introduces innovative control solutions for Battery Energy Storage Systems (BESS), Generators, and Electric Vehicles (EVs), utilizing the Time Of Use (TOU) functionality embedded in all SATEC meters, thus eliminating the need for additional Programmable Logic Controllers (PLCs).

What is TOU?

Time-of-Use (TOU) is an energy pricing strategy that differentiates rates based on It's based on day of week, time of day, and season. This approach is employed by utilities to manage peak demand by imposing varying tariffs, with increased rates during typical peak consumption periods.

SATEC devices and TOU

SATEC devices support up to 8 TOU Profiles, 16 Registers groups, and a maximum of 32 calendar/season settings.



Configuring TOU via PAS Software:

The initial step involves configuring the TOU calendar and TOU Daily Profiles within the device.

Billing/TOU Registers | TOU Daily Profiles | TOU Calendar

TOU Calendar										
No.	Season/Period	Day Type	Week of Month	Weekday	Till Weekday	Month	Day	Till Month	Till Day	Year
1	#1	#1	---	Sunday	Thursday	July	---	August	---	---
2	#1	#2	---	Friday	---	July	---	August	---	---
3	#1	#3	---	Saturday	---	July	---	August	---	---
4	#2	#1	---	Sunday	Thursday	December	---	February	---	---
5	#2	#2	---	Friday	---	December	---	February	---	---
6	#2	#3	---	Saturday	---	December	---	February	---	---
7	#3	#1	---	Sunday	Thursday	March	---	June	---	---
8	#3	#2	---	Friday	---	March	---	June	---	---
9	#3	#3	---	Saturday	---	March	---	June	---	---
10	#3	#1	---	Sunday	Thursday	September	---	November	---	---
11	#3	#2	---	Friday	---	September	---	November	---	---
12	#3	#3	---	Saturday	---	September	---	November	---	---
13	---	---	---	---	---	---	---	---	---	---
14	---	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---

Open Save as... Clear Print Send Receive

OK Cancel Apply Help

Billing/TOU Registers | TOU Daily Profiles | TOU Calendar

Daily Tariff Profile		
Season	Day Type	
#1	#1	
No.	Tariff Start Time	Tariff No.
1	00:00	#3
2	07:00	#2
3	10:00	#1
4	17:00	#2
5	21:00	#3
6	00:00	#1
7	00:00	#1
8	00:00	#1

Open
Save as...
Clear
Clear All
Print
Send
Receive

Billing/TOU Registers | TOU Daily Profiles | TOU Calendar

Billing/TOU Registers						Register Source List			
Reg.	TOU	Use Profile	Dmd Profile	Sum Profile	Units	No.	Source Input	Multiplier	Target
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	kWh	1	kWh IMPORT	1.000	Reg #1
2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	kvarh	2	kvarh IMPORT	1.000	Reg #2
3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	3	---	---	---
4	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	4	---	---	---
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	5	---	---	---
6	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	6	---	---	---
7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	7	---	---	---
8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	8	---	---	---
9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	9	---	---	---
10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	10	---	---	---
11	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	11	---	---	---
12	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	12	---	---	---
13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	13	---	---	---
14	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	14	---	---	---
15	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	15	---	---	---
16	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	---	16	---	---	---

Open Save as... Default Print Send Receive

OK Cancel Apply Help

After configuring TOU settings, press Send to upload the data to the device and activate the TOU profiles.

Using the configured TOU profiles, the user may set triggers for various operations within the capabilities of the specific device model.

Setting these triggers enables events, such as relay operation, or reading the setpoint flag via Modbus, providing a robust control mechanism.



Supported Devices

EM133

- Features an on-board relay, making it well-suited for TOU applications.
- Trigger can be set only for Tariff.

EM133 - General Setup

Pulse/Event Counters		Device Options		Local Settings		Transformer Correction		Display Setup	
Basic Setup		Control/Alarm Setpoints		Analog Inputs		Analog Outputs		Relay Outputs	
Control/Alarm Setpoints									
No.	Trigger parameter	Operate limit	Release limit	Operate delay	Release delay	Action			
1	MINUTE INTERVAL	15	----	0.0	0.0	DATA LOG #1			
2	TOU TARIFF	#1	----	5.0	5.0	OPERATE REL #1			
3	----	----	----	----	----	----			
4	RELAY #1 ON	----	----	0.0	0.0	EVENT LOG			

SATEC EM133 is an energy meter, ideal for a wide range of applications such as revenue metering, industrial power monitoring, and for interfacing with SCADA in utility substations.

- Accuracy: Class 0.5 / 0.5S per ANSI / IEC 62053-22
- MID certified
- Up to 19 Digital & Analog I/O
- Broad-range frequency measurement: 25-400 Hz



PM17X, PRO Series, PM180, EM720/920

These devices offer flexibility with the choice of separate or complex setpoints for TOU profiles and tariffs.

Basic Setup	Device Options	Transformer Correction	Transformer/Line Loss Compensation	Display Setup
Control/Alam Setpoints	Periodic Timers	Pulse/Event Counters	Digital Inputs	Relay Outputs
Local Settings				

Setpoint No.

Setpoint Triggers					
OR/AND	Input Group	Trigger Parameter	Relation	Operate limit	Release limit
OR	TOU PRMS	ACTIVE TARIFF	=	#1	----
OR	TOU PRMS	ACTIVE PROFILE	=	#1	----
OR	----	----	----	----	----
OR	----	----	----	----	----

Actions			
No.	Action	Target	Parameter
1	SET EVENT FLAG	#1	----
2	OPERATE RELAY	#1	----
3	----	----	----
4	----	----	----

Delays, s	
Operate delay	0.000
Release delay	0.000

The **PM180** is a high-performance Class Power Quality Analyzer that can simultaneously host several applications, including Phasor Measurement Unit functionality.

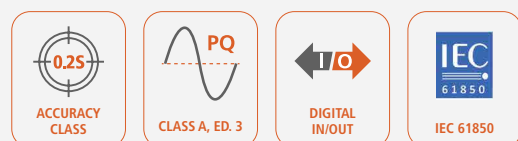
- Power Quality Analyzer (Class A)
- Up to 48 digital and analog I/O
- PMU per IEEE C37.118.1
- Disturbance Direction Detection



For further information on [this device](#) ↻

The **PRO** series combines metering, control and Class A Power Quality analysis, providing a solution for substation automation and energy management, bundling multiple capabilities in one device.

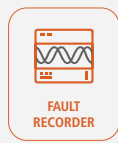
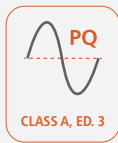
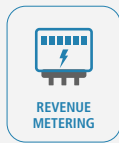
- AC/DC metering
- Power Quality Analyzer (Class A):
- IEC 61850
- Dual port Ethernet



For further information on [this device](#) ↻

EM720/920: these unique devices combine highly accurate revenue grade metering with Class A power quality analysis. This includes virtual metering, based on transformer and lines losses calculation.

- Power Quality Analyzer (Class A)
- Revenue grade metering (Class 0.2S)
- Virtual Metering Point (calculated)
- Six-hour operation back-up battery (EM720)



For further information on these devices [EM720](#) / [EM920](#)

Possible Applications | BESS and Generators

Tariff Optimization – BESS/Generators

Set triggers to optimize the operation of BESS and generators based on specific tariff structures, considering different rates during peak and off-peak hours and seasons.

EV | Charging Optimization

Utilize triggers to schedule charging of EV during off-peak TOU periods when electricity rates are lower. This helps lower charging costs for EV owners, and reduces the load on the grid during peak hours.

Employ triggers in fleet management systems to coordinate the charging schedules of multiple EVs according to most cost-effective tariffs from the utility.

Mobile Energy Storage

Configure triggers to allow bidirectional charging, turning EVs into mobile energy storage units. During high TOU rates, EVs can discharge stored energy back to the grid, or power homes and businesses.

General Incentive Programs

Utilize triggers to align EV charging, BESS or Generators with utility incentive programs that offer discounts or rewards for charging during specific TOU periods.