SolaX_VPP function Definition of ESS

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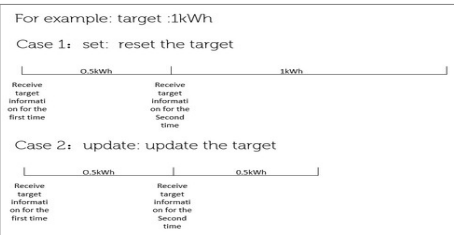
https://kb.solaxpower.com/solution/detail/2c9fa4148ecd09eb018edf67a87b01d2

Remote Control Logical Introduction (required registers)

Write multiple register						
Register	**Variable**	**W/R**	**Description**	**Unit**	**Data format**	**Length**
0x007C	ModbusPowerControl	W	0: disable remote control 1: enable power control mode 2: enable electric quantity target control mode (This is based on kWh as the command target) 3: enable SOC target control mode (This is based on SOC as the command target) 4: Push Power-Positive/Negative Mode 5: Push Power – Zero Mode 6: Self-Consume -Charge/Discharge Mode 7: Self-Consume-Charge Only Mode	1	Uint16	1
0x007D	TargetSetType	W	The response logic for receiving this target value: (for all modes) 1: set: reset the target (After the target value is received for the second time, the current value is directly accumulated again) 2: update: update the target (After receiving the target value for the second time, the data is accumulated to the second target value cut-off)	1	Uint16	1

						
0x007E ~0x007F	RemoteControl ActivePower	W	0x007E(LSB) 0x007F(MSB) (Positive means charge; Negative means discharge) (for mode 1: active power control)	1W	int32	2
0x0080 ~0x0081	RemoteControl ReactivePower	W	0x0080(LSB) 0x0081(MSB) (Positive means Inductive reactive power; Negative means Capacitive reactive power) (for mode 1: Reactive Power control)	1Var	int32	2
0x0082	Time_of_Duration	W	The duration time of the power control mode (for mode 1: How long should the current target value be maintained)	1s	Uint16	1
0x0083	TargetSoc	W	SOC as target value (for mode 3)	1%	Uint16	1
0x0084 ~0x0085	TargetEnergy	W	0x0084(LSB) 0x0085(MSB) electric quantity as target value (for mode 2)	1Wh	Uint32	2
0x0086 ~0x0087	Charge_Discharg_Power	W	0x0086(LSB) 0x0087(MSB) The power of charging or discharging (Positive means charge; Negative means discharge) (for mode 2 and 3: how much	1W	Int32	2

			power should be used to achieve the set target value)			
0x0088	RemoteCtrlTimeOut	W	Timeout counter (for all modes) How long the current mode lasts after the set target value is completed, if not updated. Take the target completion as the mark bit, start timing, if it is not completed, no timing. For example, if RemoteCtrlTimeQut is set to 600s, then at 600 seconds after the target completion of the command, the device will exit Modbus Remote Control Mode and return to the mode it was in before entering Modbus Remote Control Mode.	1s	Uint16	1
0x0089 **~0x008A**	PushModePower		0x0089(LSB) 0x008A(MSB) The power of battery charging or discharging (**Positive means battery discharge; Negative means battery charge**) (for mode 4)	1W	int32	2
0x00A0	PowerControlMode	W	Select Power Control Mode 8: PV&BAT Individual Setting – **Duration Mode** 9: PV&BAT Individual Setting – **Target SOC Mode**	1	Uint16	1
0x00A1	TargetSetType	W	1: Set Target 2: Update Target	1	Uint16	1
0x00A2 0x00A3	PVPowerLimit	W	0x00A2: LSB of PV Power Limit 0x00A3: MSB of PV Power Limit	1W	Uint32	2
0x00A4 0x00A5	PushModePower	W	Battery power target (positive discharge, negative charge) 0x00A4: LSB of PushModePower	1W	Int32	2

			0x00A5: MSB of PushModePower			
0x00A6	Time of Duration	W	Time of Duration: when choose mode 8 (PowerControlMode == 8);	1s	Uint16	1
	Target SOC		Target SOC: when choose mode 9 (PowerControlMode == 9); Range 0~100%	1%	Uint16	1
0x00A7	RemoteControlTimeOut	W	Remote Control Timeout	1s	Uint16	1

Operation Introduction

Unlock the Controlled Device

For parameter writing operation, unlocking process is required first. This unlock password is the same as the unlock password required before doing parameter setting locally on the inverter, and the default is "2014". After unlocking, the system will always be in the unlocked state unless an invalid password is written again or the system is rebooted.

Unlock Address:

Function code 0x06, register 0x0000

▪ 6. Write Single Register

Function Code	Write Single Register						
	register	variable	W/R	decription	unit	data format	lenth
0X06	0x0000	UnlockPassword	W	UnlockPassword	1	Uint16	1
	0x0001	Vpv_Start	W	Vpv_Start (1000~5500)	0.1V	Uint16	1
	0x0002	T_Start	W	T_Start (0~300)	1S	Uint16	1
	0x0003	Vpv_High_Stop	W	Vpv_High_Stop (1000~6000)	0.1V	Uint16	1
	0x0004	Vpv_Low_Stop	W	Vpv_Low_Stop (100~5500)	0.1V	Uint16	1
				Vac_Min			

You can also query the lock status of the device.

Query Address:

Function code 0x04, register 0x0054

▪ 0x04:Read Input Register

32bit data use little endian format

Function code	Read Input Register						
	Register	Variable	W/R	Decription	Unit	Data format	Lenth
0X04	0x0000	GridVoltage(X1)	R	GridVoltage	0.1V	uint16	1
	0x0054	Lock State	R	0:locked 1:unlocked	-	uint16	1
	0x0055 ~0x0065	REV	R	REV	-	uint16	17
	0x0066	BusVolt	R	BusVolt	0.1V	uint16	1
	0x0067	wDcvFaultVal	R	wDcvFaultVal	0.1V	uint16	1
	0x0068	wOverLoadFaultval	R	wOverLoadFaultval	1W	uint16	1
	0x0069	wBatteryVoltFaultVal	R	wBatteryVoltFaultVal	0.1V	uint16	1

Parameter Setting of Remote Control (VPP)

0x007C~0x008A is the index of Remote Control (VPP function) multi-write control (function code 0x10). When using it, please select the corresponding parameter to fill and write according to the required mode. It is recommended to fill all the values for all registers 0x007C~0x008A, when writing a command. Filling any values in the registers that are not related to the current mode will not affect the current mode, and "0" is recommended for irrelevant values.

- **Note: For inverters, the written values need to be in hexadecimal data format.**

Further details on how to set each parameter to realize various types of control can be found in Section 2.3, "Details of each mode".

Details of each mode

Mode 1: Power Control Mode

Model 1 Description:

This mode controls the active and reactive power at the AC port of the inverter for a period of time. In this mode the PV runs at the highest possible power and the system can feed/take power to/from the grid.

Exit logic: The exit of mode 1 based on the two limit values, “Time_of_Duration” and “RemoteCtrlTimeOut”. That is, the “Time_of_Duration” is judged first, if during this period there is no new power target command, then continue to wait for the time of “RemoteCtrlTimeOut”, if “RemoteCtrlTimeOut” is satisfied, then the mode 1 is exited to the regular work mode of the inverter.

The key of the model is that the system will try to meet the target power as much as possible.

In this mode the AC port power target is positive for charging and negative for discharging; the battery input represents charging and the output represents discharging; the PV is always the input to the inverter.

Control Mode	Register	Variable	Unit
mode 1 (power control mode)	0x007C	ModbusPowerControl	1
	0x007D	TargetSetType	1
	0x007E	RemoteControl ActivePower	1W
	0x007F		
	0x0080	RemoteControl ReactivePower	1W
	0x0081		
	0x0082	Time_of_Duration	1s
	0x0088	RemoteCtrlTimeOut	1s

- If a command is given to set the active power “+x” W (x>0), it means that we want the inverter AC port to [input] active power “x” W. That is, at this point, the load is fully fed by the grid, and in addition to the load's consumption, the inverter buys “x” W of electrical power from the grid.

- If $P_{PV\,max} + x \le P_{BAT\,input\,max}$,

$$\text{then} \begin{cases} P_{AC\,input} = x \\ P_{PV} = P_{PV\,max} \\ P_{BAT\,input} = P_{PV\,max} + x\,(charging) \end{cases};$$

The input power of inverter's AC port is "x" W, the PV is running at maximum power, the battery input power "$P_{BAT\ input}$=P_{PVmax}+x", and the battery state is charging;

- If $\begin{cases} P_{PV\,max} < P_{BAT\,input\,max}, \\ P_{PV\,max} + x > P_{BAT\,input\,max} \end{cases}$,

$$\text{then} \begin{cases} P_{PV} = P_{PV\,max} \\ P_{AC\,input} = P_{BAT\,input\,max} - P_{PV\,max} < x \\ P_{BAT\,input} = P_{BAT\,input\,max}\,(charging) \end{cases};$$

The input power of inverter's AC port is adjusted to "$P_{BAT\ input}$-P_{PVmax}", which is smaller than "x". The PV is running at maximum power, and the battery is charging at maximum power, i.e. "$P_{BAT\ input\ max}$". **Although the actual situation is not reaching the requirement of the command, the system will not report an error in this case.**

- If $P_{PV\,max} \ge P_{BAT\,input\,max}$,

$$\text{then} \begin{cases} P_{AC\,input} = 0 \\ P_{PV} = P_{BAT\,input\,max} \\ P_{BAT\,input} = P_{BAT\,input\,max}\,(charging) \end{cases};$$

The input power of inverter's AC port is adjusted to "0", the PV adjusts its power to "$P_{BAT\ input\ max}$", and the battery is charging at maximum power, i.e. "$P_{BAT\ input\ max}$". **Although the actual situation is not reaching the requirement of the command, the system will not report an error in this case.**

- If a command is given to set the active power "-x" W (x>0), it means that we want the inverter AC port to [output] active power "x" W.

- If $P_{PV\,max} + P_{BAT\,output\,max} < x,$

$$\text{then} \begin{cases} P_{PV} = P_{PV\,max}, \\ P_{AC\,output} = P_{PV\,max} + P_{BAT\,output\,max} < x \\ P_{BAT\,output} = P_{BAT\,output\,max}\,(discharging) \end{cases};$$

The output power of inverter's AC port is "$P_{PV\ max}$+$P_{BAT\ input\ max}$", the PV is running at maximum power, the battery is discharging at maximum power, i.e. "$P_{BAT_{outputmax}}$". **Although the actual situation is not reaching the requirement of the command, the system will not report an error in this case.**

- If $\begin{cases} P_{PV\,max} < x \\ P_{PV\,max} + P_{BAT\,output\,max} \geq x' \end{cases}$

$$\text{then} \begin{cases} P_{AC\,output} = x \\ P_{PV} = P_{PV\,max} \\ P_{BAT\,output} = x - P_{PV\,max}\,(discharging) \end{cases};$$

The output power of inverter's AC port is "x" W, the PV is running at maximum power, the battery output power is "x-$P_{PV\ max}$", battery is discharging.

- If $P_{PV\,max} \geq x,$

then $P_{AC\ output}$=x, and the excess PV power will charge the battery, but this is also related to the charging/discharging capacity of the battery at the moment. In this case, there are two possibilities:

a) If $P_{BAT\,input\,max} \geq P_{PV\,max} - x,$

$$\text{then} \begin{cases} P_{AC\,output} = x \\ P_{PV} = P_{PV\,max} \\ P_{BAT\,input} = P_{PV\,max} - x\,(charging) \end{cases}$$

The output power of inverter's AC port is "x" W, the PV is still running at maximum power, the battery charging power is "$P_{PV\ max}$-x".

b) If $P_{BAT\ input\ max} < P_{PV\ max} - x$,

$$\text{then} \begin{cases} P_{AC\ output} = x \\ P_{PV} = P_{BAT\ input\ max} + x \\ P_{BAT\ input} = P_{BAT\ input\ max}\ (charging) \end{cases}$$

The output power of inverter's AC port is "x" W, the PV adjusts its power to "$P_{BAT\ input\ max}$+x", and the battery is charging at the maximum charging power at the moment, i.e. "$P_{BAT\ input\ max}$".

- The setting of **Reactive Power** is mostly used for the scenarios of regulation and control by the grid company.

Case study 1.1:

- Pre-commission:

Inverter work mode: Self-Use Mode

P(PV) = 2000W

P(BAT) = 1000W (battery charging)

P(AC) = -1000W (inverter output)

P(Load) = 1000W (load consumption)

Grid Meter = 0

- User Requirement:

Inverter AC port output active power 5000W;

PV runs at maximum power if possible;

The above state lasts for 5 minutes;

- Write Command:

Register	Variable	Unit	Case Study 1.1 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	1	0x0001
0x007D	TargetSetType	1	1	0x0001
0x007E	RemoteControl ActivePower	1W	-5000	0xEC78
0x007F			0	0xFFFF
0x0080	RemoteControl ReactivePower	1W	0	0x0000
0x0081	Time_of_Duration	1s	0	0x0000
0x0082			300	0x012C
0x0088	RemoteCtrlTimeOut	1s	600	0x0258

- Situation under Remote Control Mode 1 (for example only, not a real situation):

Power Control Mode

P(PV) = P(PV max) = 2000W (This is the maximum value in the example environment.)

P(BAT) = -3000W (battery discharging)

P(AC) = -5000W (inverter output)

P(Load) = 1000W (load consumption)

Grid Meter = 4000W (feed into grid)

The above condition lasts for 300s and then the AC port stops outputting. After this continues for 600s, the inverter returns to Self-Use mode.

Case study 1.2:

- Pre-commission:

Remote Control Mode 1 (VPP control); before entering this remote control mode 1, the inverter’s work mode is Backup mode.

P(PV) = 4000W

P(BAT) = 1000W (battery charging)

P(AC) = -3000W (inverter output)

P(Load) = 3000W (load consumption)

Grid Meter = 0

- User Requirement:

Remote Control Mode 1 + Updated target

Inverter AC port input active power 1000W;

PV runs at maximum power if possible;

The above state lasts for 5 minutes;

- Write Command:

Register	Variable	Unit	Case Study 1.2 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	1	0x0001
0x007D	TargetSetType	1	2	0x0002
0x007E	RemoteControl ActivePower	1W	1000	0x03E8
0x007F			0	0x0000
0x0080	RemoteControl ReactivePower	1W	0	0x0000
0x0081	Time_of_Duration	1s	0	0x0000
0x0082			300	0x012C
0x0088	RemoteCtrlTimeOut	1s	600	0x0258

- Situation under Remote Control Mode 1 (for example only, not a real situation):

Power Control Mode

P(PV) = P(PV max) = 4000W

P(BAT) = P(BAT max) = 4500W (battery charging) (It is the maximum charging power of the battery under this example conditions.)

P(AC) = 500W (inverter input)

P(Load) = 3000W (load consumption)

Grid Meter = -3500W (take from grid)

The above condition lasts for 300s and then the AC port stops inputting. After this continues for 600s, the inverter returns to Backup mode.

Mode 2: Electric Quantity Target Control Mode

Model 2 Description:

This mode controls the AC port of the inverter to input/output a certain amount of electric energy with a certain power. In this mode the PV runs at the highest possible power and the system can feed/take power to/from the grid.

Exit logic: if the energy target value (0x0084 & 0x0085) is not updated within the set time (0x0088) after completing the commands, then this mode exits. **When the energy target value is not reached, the mode runs until the next command is entered.**

Control Mode	Register	Variable	Unit
mode 2 (electric quantity target control mode)	0x007C	ModbusPowerControl	1
	0x007D	TargetSetType	1
	0x0084	TargetEnergy	1Wh
	0x0085		
	0x0086	Charge_Discharg_Power	1W
	0x0087		
	0x0088	RemoteCtrlTimeOut	1s

- If a command is given to set the power “+x” W (), it means that we want the inverter AC port to [input] active power “x” W. That is, at this point, the load is fully fed by the grid, and in addition to the load's consumption, the inverter buys “x” W of electrical power from the grid.

Like mode 1, here in Mode 2, when AC port input power, it contains exactly **the same three categorized discussion scenarios**. Therefore, for details on these scenarios please refer to the “Model 1 Description”.

- If a command is given to set the power “-x” W (), it means that we want the inverter AC port to [output] active power “x” W.

Like mode 1, here in Mode 2, when AC port output power, it also contains exactly **the same three categorized discussion scenarios**. Therefore, for details on these scenarios please refer to the “Model 1 Description”.

Case study 2.1:

- Pre-commission:

X3-Hybrid G4 + 4*T30, Inverter work mode: Self-Use Mode, Battery SOC: 20%

P(PV) = 1000W

P(BAT) = 0

P(AC) = -1000W (inverter output)

P(Load) = 1000W (load consumption)

Grid Meter = 0

- User Requirement:

Let the AC port of the inverter input 2000Wh into the system with a power of 1000W.

- Write Command:

Register	Variable	Unit	Case Study 2.1 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	2	0x0002
0x007D	TargetSetType	1	1	0x0001
0x0084	TargetEnergy	1Wh	2000	0x07D0
0x0085			0	0x0000
0x0086	Charge_Discharg_Power	1W	1000	0x03E8
0x0087			0	0x0000
0x0088	RemoteCtrlTimeOut	1s	600	0x0258

- Situation under Remote Control Mode 2 (for example only, not a real situation):

Electric Quantity Target Control Mode

P(PV) = P(PV max) = 1000W

P(BAT) = 1500W (battery charging) (It is the maximum charging power of the battery under this example conditions.)

P(AC) = 500W (inverter input) (The request for the command was not achieved, but the system will not report an error.)

P(Load) = 1000W (load consumption)

Grid Meter = -1500W (take from grid)

The Electric Quantity Target Control Mode will exit after 600 seconds after 2000Wh is input to the AC port of the inverter and the inverter will return to Self-Use mode.

Case study 2.2:

- Pre-commission:

X3-Hybrid G4 + 2*T30, Remote Control Mode 2, Battery SOC: 31%

Before entering this remote control mode 2, the inverter’s work mode is Backup mode.

P(PV) = 2000W

P(BAT) = 1000W (battery charging)

P(AC) = -1000W (inverter output)

P(Load) = 1000W (load consumption)

Grid Meter = 0

- User Requirement:

Update the target value in Mode 2, and let the AC port of the inverter output 9000Wh of electric energy with a power of 3000W.

- Write Command:

Register	Variable	Unit	Case Study 2.2 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	2	0x0002
0x007D	TargetSetType	1	2	0x0001
0x0084	TargetEnergy	1Wh	2000	0x07D0
0x0085			0	0x0000
0x0086	Charge_Discharg_Power	1W	-3000	0xF448
0x0087			0	0xFFFF
0x0088	RemoteCtrlTimeOut	1s	600	0x0258

- Situation under Remote Control Mode 2 (for example only, not a real situation):

Electric Quantity Target Control Mode

P(PV) = P(PV max) = 2000W

P(BAT) = -1000W (battery discharging)

P(AC) = -3000W (inverter output)

P(Load) = 1000W (load consumption)

Grid Meter = 2000W (feed into grid)

After some time, the battery SOC will drop to the system default minimum SOC, 10%. At this time, the battery is no longer discharged, so the output of the system is only provided by the PV. If the current PV power can meet the requirements of the command, then the system outputs according to the requirements of the command; if the current PV power cannot meet the requirements of the command, then the system outputs according to the maximum power at the moment.

The Electric Quantity Target Control Mode will exit after 600 seconds after the AC port of the inverter output 9000Wh and the inverter will return to Backup mode.

Mode 3: SOC Target Control Mode

Model 3 Description:

This mode controls the AC port of the inverter to input/output with a certain power and takes the battery SOC as the target value. In this mode the PV runs at the highest possible power and the system can feed/take power to/from the grid.

Exit logic: if the SOC target value (0x0083) is not updated within the set time (0x0088) after completing the commands, then this mode exits. **When the SOC target value is not reached, the mode runs until the next command is entered.**

Note: This mode can only work when the current battery SOC has not reached the target SOC. For example, if the current battery SOC is 50% and the command requires a certain power input from the AC port and the target SOC is 40%, then the system will directly exit the SOC target control mode.

Control Mode	Register	Variable	Unit
mode 3 (SOC target control mode)	0x007C	ModbusPowerControl	1
	0x0083	TargetSoc	1%
	0x0086	Charge_Discharg_Power	1W
	0x0087		
	0x0088	RemoteCtrlTimeOut	1s

Case study 3:

- Pre-commission:

X3-Hybrid G4 + 2*T30, Inverter work mode: Self-Use Mode, Battery SOC: 60%

P(PV) = 3000W

P(BAT) = 1000W (battery charging)

P(AC) = -2000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = 0

- User Requirement:

Set the output power of the AC port of the inverter to 4000W and discharge the battery to 30% SOC.

- Write Command:

Register	Variable	Unit	Case study 3 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	3	0x0003
0x0083	TargetSoc	1%	30	0x001E
0x0086	Charge_Discharg_Power	1W	-4000	0xF060
0x0087			0	0xFFFF
0x0088	RemoteCtrlTimeOut	1s	600	0x0258

- Situation under Remote Control Mode 3 (for example only, not a real situation):

SOC Target Control Mode

P(PV) = P(PV max) = 3000W

P(BAT) = -1000W (battery discharging)

P(AC) = -4000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = 2000W (feed into grid)

If the above working conditions are constant, then the SOC target (down to 30% SOC) will be completed in about 1.8 hours.

Mode 4: Push Power - Positive/Negative Mode

Model 4 Description:

This mode directly controls the battery charging/discharging power, the PV power is as high as possible and the system can feed/take power to/from the grid.

The positive and negative values of the data in this model are defined as: positive means battery discharge, negative means battery charge.

Control Mode	Register	Variable	Unit
mode 4 (Push Power - Positive/Negative Mode)	0x007C	ModbusPowerControl	1
	0x0089	PushModePower **(Positive means battery discharge; Negative means battery charge)**	1W
	0x008A		

Case study 4.1:

- Pre-commission:

X3-Hybrid G4 + 4*T58, Inverter work mode: Self-Use Mode, Battery SOC: 70%

P(PV) = 2000W

P(BAT) = 0

P(AC) = -2000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = 0

- User Requirement:

Battery discharging power 1000W;

PV runs at maximum power if possible;

- Write Command:

Register	Variable	Unit	Case study 4.1 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	4	0x0004
0x0089	PushModePower	1W	+1000	0x03E8
0x008A				0x0000

- Situation under Remote Control Mode 4 (for example only, not a real situation):

Push Power – Positive/Negative Mode

P(PV) = P(PV max) = 2000W

P(BAT) = -1000W (battery discharging)

P(AC) = -3000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = 1000W (feed into grid)

Case study 4.2:

- Pre-commission:

Inverter work mode: Self-Use Mode

P(PV) = 2000W

P(BAT) = 0

P(AC) = -2000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = 0

- User Requirement:

Battery charging power 1000W;

PV runs at maximum power if possible;

- Write Command:

Register	Variable	Unit	Case study 4.2 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	4	0x0004
0x0089	PushModePower (negative means battery charge)	1W	-1000	0XFC18
0x008A				0XFFFF

- Situation under Remote Control Mode 4 (for example only, not a real situation):

Push Power – Positive/Negative Mode

P(PV) = P(PV max) = 2000W

P(BAT) = 1000W (battery charging)

P(AC) = -1000W (inverter output)

P(Load) = 2000W (load consumption)

Grid Meter = -1000W (take from grid)

Mode 5: Push Power - Zero Mode

Model 5 Description:

The battery does not charge or discharge, the PV power is as high as possible, and the system can feed/take power to/from the grid. The batteries remain powered but do not work, and the hybrid inverter is working similar to an on-grid inverter (string inverter).

Control Mode	Register	Variable	Unit
mode 5 (Push Power – Zero Mode)	0x007C	ModbusPowerControl	1

Case study 5:

- Pre-commission:

Inverter work mode: Self-Use Mode

P(PV) = 2000W

P(BAT) = 1000W (battery charging)

P(AC) = -1000W (inverter output)

P(Load) = 1500W (load consumption)

Grid Meter = -500W (take from grid)

- User Requirement:

The battery does not charge or discharge, the PV power is as high as possible, and the system is allowed to feed/take power into/from the grid.

- Write Command:

Register	Variable	Unit	Case study 5 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	5	0x0005

- Situation under Remote Control Mode 5 (for example only, not a real situation):

Push Power - Zero Mode

P(PV) = P(PV max) = 2000W

P(BAT) = 0

P(AC) = -2000W (inverter output)

P(Load) = 1500W (load consumption)

Grid Meter = 500W (feed into grid)

Mode 6: Self-Consume - Charge/Discharge Mode

Model 6 Description:

The battery can be charged from PV only, no charge from grid. Battery discharge depending on the load and PV. If the PV input power cannot cover the consumption of the load, then the battery can be discharged; if the battery is fully charged, then the excess PV power can be fed to the grid. The priority of the PV input is: load > battery > grid. This is like Self-Use mode.

Control Mode	Register	Variable	Unit
mode 6 (Self-Consume-Charge/Discharge Mode)	0x007C	ModbusPowerControl	1

Case study 6:

- Pre-commission:

X3-Hybrid G4 + 4*T58, Inverter work mode: Self-Use Mode, Battery SOC: 40%.

A forced charging period has been set, during which the inverter is allowed to charge from the grid.

P(PV) = 1000W

P(BAT) = 5000W (battery charging)

P(AC) = 4000W (inverter input)

P(Load) = 3000W (load consumption)

Grid Meter = -7000W (take from grid)

- User Requirement:

It's just like the description of mode 6.

- Write Command:

Register	Variable	Unit	Case study 6 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	6	0x0006

- Situation under Remote Control Mode 6 (for example only, not a real situation):

Self-Consume - Charge/Discharge Mode

P(PV) = P(PV max) = 1000W

P(BAT) = -2000W (battery discharging)

P(AC) = -3000W (inverter output)

P(Load) = 3000W (load consumption)

Grid Meter = 0

Mode 7: Self-Consume - Charge Only Mode

Model 7 Description:

The battery can be charged from PV only, no charge from grid. Battery discharge is not allowed. Import from grid if necessary, export to grid if battery full.

Control Mode	Register	Variable	Unit
mode 7 (Self-Consume-Charge Only Mode)	0x007C	ModbusPowerControl	1

Case study 7:

- Pre-commission:

Inverter work mode: Self-Use Mode

A forced charging period has been set, during which the inverter is allowed to charge from the grid.

P(PV) = 1000W

P(BAT) = 5000W (battery charging)

P(AC) = 4000W (inverter input)

P(Load) = 3000W

Grid Meter = -7000W (take from grid)

- User Requirement:

It's just like the description of mode 7.

- Write Command:

Register	Variable	Unit	Case study 7 (decimal)	Write Value (hexadecimal)
0x007C	ModbusPowerControl	1	7	0x0007

- Situation under Remote Control Mode 7 (for example only, not a real situation):

Self-Consume - Charge Only Mode

P(PV) = P(PV max) = 1000W

P(BAT port) = 0

P(AC) = -1000W (inverter output)

P(Load) = 3000W

Grid Meter = -2000W (take from grid)

Mode 8: PV&BAT Individual Setting – Duration Mode

Mode 8 Description:

The battery can be charged from PV and grid simultaneously, and PV power and BAT power can be set independently. In addition, the photovoltaic power generation can be limited to zero, ensuring that the inverter can absorb power from the grid at its maximum capacity.

Exit: This mode is exited via **Time of Duration（0X00A6）**.

Control Mode	Register	Variable	Unit
mode 8 (PV&BAT Individual Setting – Duration Mode)	0x00A0	PowerControlMode	1
	0x00A1	TargetSetType	1
	0x00A2	PVPowerLimit(LSB)	1W
	0x00A3	PVPowerLimit(MSB)	1W
	0x00A4	PushModePower(LSB)	1W
	0x00A5	PushModePower(MSB)	1W
	0x00A6	Time of Duration	1s
	0x00A7	RemoteControlTimeOut	1s

Case Study 8:

- Pre-commission:

Work Mode = self-use

Max Discharge current = 30.0

Max charge current = 30.0

No limit in Export Control / Power Limit / Main Breaker Limit

A forced charging period has been set, during which the inverter is allowed to charge from the grid.

- Scenario:

P(PV) = 1000 W

P(BAT) = 5000 W (battery charging)

P(AC) = 4000 W (inverter take-in)

P(Load)= 3000W

Grid Meter = -7000W (absorb from grid)

- User Requirement:

PV Power can be restricted to 0 W.

Maximal absorption of grid power during negative-tariff period.

According to negative-tariff period, inverter can execute for a certain period of time. (For example, 30 minutes)

- Write Command:

Register	Variable	Unit	Write Value (decimal)	Write Value (hexadecimal)
0x00A0	PowerControlMode	1	8	0x0008
0x00A1	TargetSetType	1	1	0x0001
0x00A2	PVPowerLimit(LSB)	1W	0	0x0000
0x00A3	PVPowerLimit(MSB)	1W	0	0x0000
0x00A4	PushModePower(LSB)	1W	-5000	0xEC78
0x00A5	PushModePower(MSB)	1W	0	0xFFFF
0x00A6	Time of Duration	1s	1800	0x0708
0x00A7	RemoteControlTimeOut	1s	2000	0x07D0

**If TargetSetType == 2, this command will execute for 30min. (Based on the start time of the former command)

- After command:

P(PV) = 0 W

P(BAT) = 5000 W (battery charging)

P(AC) = 4000 W (inverter take-in)

P(Load)= 3000W

Grid Meter = -8000W (absorb from grid)

You will take in more electric energy (Approximately 0.5kWh, if BAT power is higher than 1000W at any time) from Grid, and earn more during negative-tariff period.

Mode 9: PV&BAT Individual Setting – Target SOC Mode

Mode 9 Description:

The battery can be charged from PV and grid simultaneously, and PV power and BAT power can be set independently. In addition, the photovoltaic power generation can be limited to zero, ensuring that the inverter can absorb power from the grid at its maximum capacity.

Exit: This mode is exited via **Target SOC**.

Control Mode	Register	Variable	Unit
mode 9 (PV&BAT Individual Setting – Target SOC Mode)	0x00A0	PowerControlMode	1
	0x00A1	TargetSetType	1
	0x00A2	PVPowerLimit(LSB)	1W
	0x00A3	PVPowerLimit(MSB)	1W
	0x00A4	PushModePower(LSB)	1W
	0x00A5	PushModePower(MSB)	1W
	0x00A6	Target SOC	1%
	0x00A7	RemoteControlTimeOut	1s

Case Study 9:

- Pre-commission:

Work Mode = self-use

Max Discharge current = 30.0

Max charge current = 30.0

No limit in Export Control / Power Limit / Main Breaker Limit

A forced charging period has been set, during which the inverter is allowed to charge from the grid.

- Scenario:

P(PV) = 1000 W

P(BAT) = 5000 W (battery charging)

SOC(BAT) = 30% (T30*2)

P(AC) = 4000 W (inverter take-in)

P(Load)= 3000W

Grid Meter = -7000W (absorb from grid)

- User Requirement:

PV Power can be restricted to 0 W.

Maximal absorption of grid power during negative-tariff period.

Set a certain Target SOC. (For example, 80%)

- Write Command:

Register	Variable	Unit	Write Value (decimal)	Write Value (hexadecimal)
0x00A0	PowerControlMode	1	8	0x0008
0x00A2	PVPowerLimit(LSB)	1W	0	0x0000
0x00A3	PVPowerLimit(MSB)	1W	0	0x0000
0x00A4	PushModePower(LSB)	1W	-5000	0xEC78
0x00A5	PushModePower(MSB)	1W	0	0xFFFF
0x00A6	Target SOC	1%	80	0x0050
0x00A7	RemoteControlTimeOut	1s	3600	0x0E10

- After command:

P(PV) = 0 W

P(BAT) = 5000 W (battery charging)

SOC(BAT) = 80% (T30*2)

P(AC) = 5000 W (inverter take-in)

P(Load)= 3000W

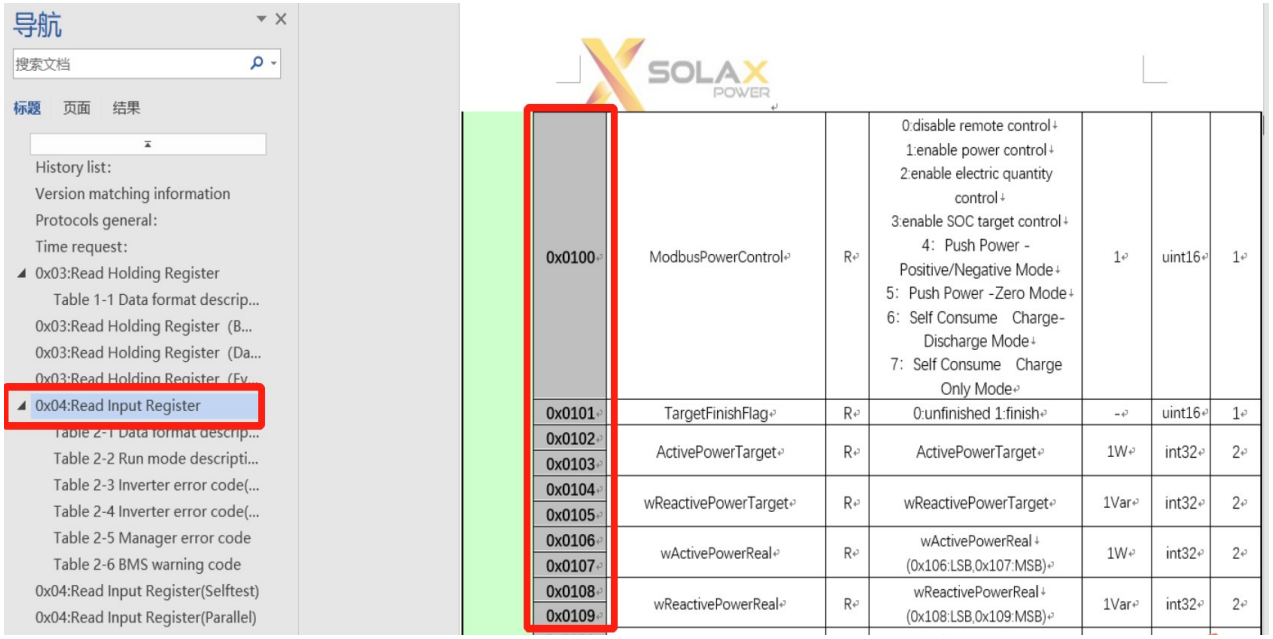
Grid Meter = -8000W (absorb from grid)

You will take in more electric energy (Approximately 0.6kWh, if BAT power is higher than 1000W at any time) from Grid, and earn more during negative-tariff period.

Querying set parameters

This section is used to verify that the currently running remote control mode is working as expected according to the set parameter values.

The query of related set parameters and the reference of the target setting range in the first, second and third modes, are provided in the function code 0x04 (Read Input Register) register, address 0x0100~0x011E, as shown below.



Operation Introduction

Model	Software Version (Mode 0-7)	Software Version (Mode 8-9)
X1-Hybrid G4	ARM1.41 / DSP1.44	Nearly in the future
X3-Hybrid G4	ARM1.40 / DSP1.41 (Mode 5 & Mode6 processing)	Nearly in the future
X1-IES	ARM9.00 / DSP 9.00 (Only mode 0-3)	Nearly in the future
X3-IES	ARM9.07	Nearly in the future
X3-ULTRA	ARM11.03 / DSP9.04	Nearly in the future