Growatt DRMS & RRCR Function

As a green source of energy, PV station installation grows massive in the past several decades worldwide.

But due to the unstable PV production and the limitation grid infrastructure, the stability and security of the grid are becoming more and more important. To ensure this, the grid operator has required a remote-control function by PV inverter.

This white paper will introduce the local control requirement in Australia and Europe area, and corresponding solution of Growatt's inverter.

With the focus on global warming and the goal of carbon neutrality, photovoltaic (PV) as a green energy source has been installed in large numbers over the past few decades.

However, due to the weather, photovoltaic power generation is not stable during the day. Sometimes there are production peaks, but at the same time the power consumption is low. The gird infrastructure cannot withstand such large fluctuations due to equipment limitations. Therefore, grid stability and security are becoming increasingly important. For this reason, grid operators require PV inverters with remote control capabilities.

DRMS requirement in Australia and New Zealand

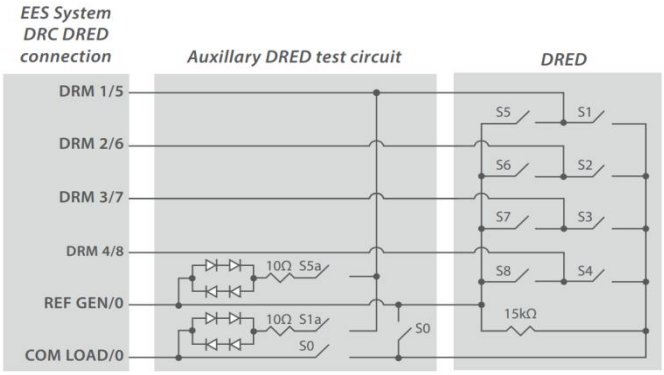
As of October 9, 2016, all grids connect inverters installed in Australia have to meet the full requirements of AS4777.2:2015. A key requirement of AS4777.2:2015 is Demand Response Mode (DRM) which enables the inverter to respond to signals sent to it remotely.

"The inverter shall support the demand response mode DRM 0 of Table 5. The inverter should support the other demand response modes of Table 5."

So, while support for all demand response modes is not currently mandatory, all inverters are required to support demand mode DRM 0 (which disconnects the inverter when the signal is received).

Mode	Requirement
DRM 0	Operate the disconnection device
DRM 1	Do not consume power
DRM 2	Do not consume at more than 50% of rated power
DRM 3	Do not consume at more than 75% of rated power and source reactive power if capable
DRM 4	Increase power consumption (subject to constraints from other active DRMs)
DRM 5	Do not generate power
DRM 6	Do not generate at more than 50% of rated power
DRM 7	Do not generate at more than 75% of rated power and sink reactive power if capable.
DRM 8	Increase power generation (subject to constraints from other active DRMs)

Table 1: Table 5 from AS/NZS 4777.2:2015



Picture 1: Appendix F from AS/NZS 4755.3:2016

RRCR requirement in Europe

In EU is also the similar functionality mandatory. The COMMISSION REGULATION (EU) 2016/631 of 14 April 2016 has required the remotely control by grid operator to improved grid stability and controllability:

The power-generating module shall be equipped with a logic interface (input port) to cease active power output within five seconds following an instruction being received at the input port. The relevant system operator shall have the right to specify requirements for equipment to make this facility operable remotely.

The concrete control logic will be defined by counties individually. For example, Germany has required a four set points for power control level: 0%-30%-60%-100%, which is also used in CZ and Swiss.

The signal from grid operator is received and transferred by a specific receiver.

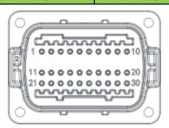
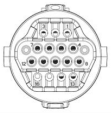
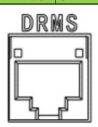
Picture 2: DRED controller used in Australia and New Zealand

Picture 3: Ripple control receiver used in Europe

Growatt's solution for DRMS and RRCR

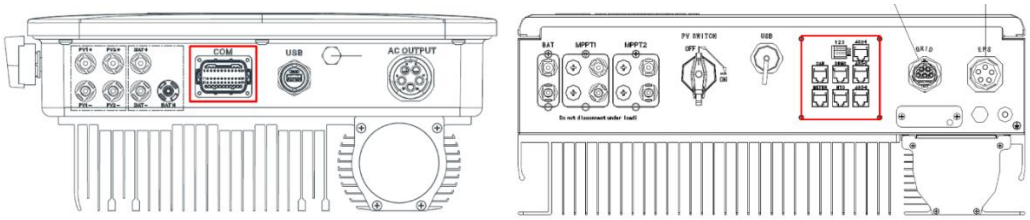
Growatt has realized this function in the inverter through the communication port. The communication port receives the control signal from receiver which controlled by local grid operator. These signals trigger the inverter to change the mode of operation, potentially turning it off, on, or ramping the output up or down.

There are 2 kinds of communication ports for DRMS/RRCR by Growatt's inverters, one is the PIN communication port by Growatt -X/ -X2/ -XH inverters. The other one is RJ45 port, which is on Growatt MIC-X/ SPH / WIT / MAX 50-80K series. Please find the corresponding port in following table:

PIN Communication Port							RJ45 Port			
MIN -X/XH	MOD TL3-X/X2	MID TL3-X	MOD TL3-XH	MID TL3-XH	MID TL3-X/X2	MAX TL3-X	MIC TL-X	MAX TL3	SPH UP	WIT -HU
										

Picture 4: Growatt inverter communication ports

We take MOD-XH series and SPH series as examples for the following introduction.



Picture 5: Communication port of MOD-XH and SPH BH UP

The definition of inverter communication port is easily found on the user manual. For example, the definition of each PIN of MOD-XH series inverter and the RJ45 definition on SPH series as the list:

PIN	Definition	Function	PIN	Definition	Function
1	+12V	Dry contact: the power supply should not be greater than 2W	16	DRM0/COM	/
2	COM		17	RS485A4	SYN communication port
3	RS485A1	Parallel communication port	18	RA485B4	
4	RS485B1		19	/	/
5	RS485A3	Meter communication port	20	/	/
6	RS485B3		21	BOX.EN+	SYN detection signal port
7	RS485A2	Battery 1 communication port	22	BOX.EN-	
8	RS485B2		23	/	/
9	WP+	Battery 1 wakeup signal	24	/	/
10	WP-		25	/	/
11	DRM1/5	Relay contact 1 input	26	/	/
12	DRM2/6	Relay contact 2 input	27	/	/
13	DRM3/7	Relay contact 3 input	28	/	/
14	DRM4/8	Relay contact 4 input	29	/	/
15	REF/GEN	GND	30	/	/

No.	CAN	METER	COM	DRMS	485-1/485-2	485-3
1	/	RS485B	DRY+	DRM1/5	RS485B	RS485B
2	/	GND	/	DRM2/6	GND	GND
3	/	/	DRY-	DRM3/7	/	/
4	CANH	/	/	DRM4/8	/	/
5	CANL	RS485A	/	REF	RS485A	RS485A
6	GND	/	/	COM	/	/
7	/	/	/	/	/	/
8	WAKEUP	/	/	/	/	/

RJ45 wiring color code:

PIN	1	2	3	4	5	6	7	8
Color	White orange	Orange	White/ Green	Blue	White/ Blue	Green	White/ Brown	Brown

Picture 6: Definition of communication port of MOD-XH and SPH BH UP

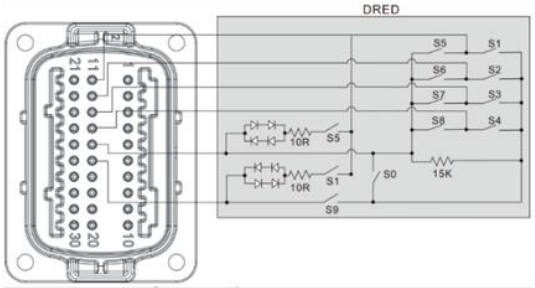
Note: Different inverter has different PIN definition, please refer to the individual user manual.

Connection between inverter and signal receiver:

1.Connection with PIN communication port

Find the correct PINs according to the PIN definition list. Then connect the wires from DRED or RRCR device to the corresponding PIN ports.

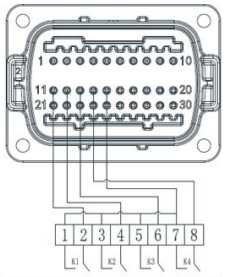
For Australia and New Zealand:



Mode	Socket asserted by shorting pins		Function
DRM 0	14	13	Operate the disconnection device.
DRM 5	9	13	Do not generate power.
DRM 6	10	13	Do not generate at more than 50% of rated power.
DRM 7	11	13	Do not generate at more than 75% of rated power and reduce the reactive power as far as possible.
DRM 8	12	13	Increase power generation (subject to constraints from other active DRMs).

Picture 7: Connection of DRED with PIN communication port

For Europe:



No.	RRCR Description	Active Power
11	K1-out	0%
12	K2-out	30%
13	K3-out	60%
14	K4-out	100%
15	Relays common node	/
16	/	/

DRM Socket Pin 11	DRM Socket Pin 12	DRM Socket Pin 13	DRM Socket Pin 14	Active power	Cos(φ)
Shorting with Pin 15				0%	1
	Shorting with Pin 15			30%	1
		Shorting with Pin 15		60%	1
			Shorting with Pin 15	100%	1

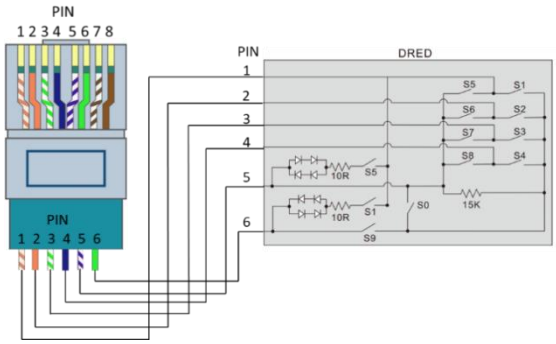
Picture 8: Connection of RRCR with PIN communication port

Caution: Excessive voltage can damage the inverter! External voltage of DRM port doesn't over +5V.

2. Connection with RJ45 communication port

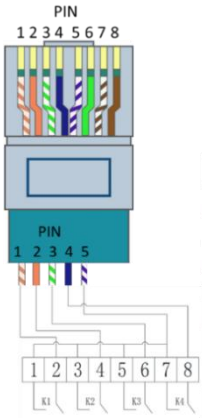
Prepare a RJ 45 LAN cable and remove one end. Then connect the concrete PINs based on the following picture.

For Australia and New Zealand:



Picture 9: Connection of DRED with PIN communication port

For Europe:



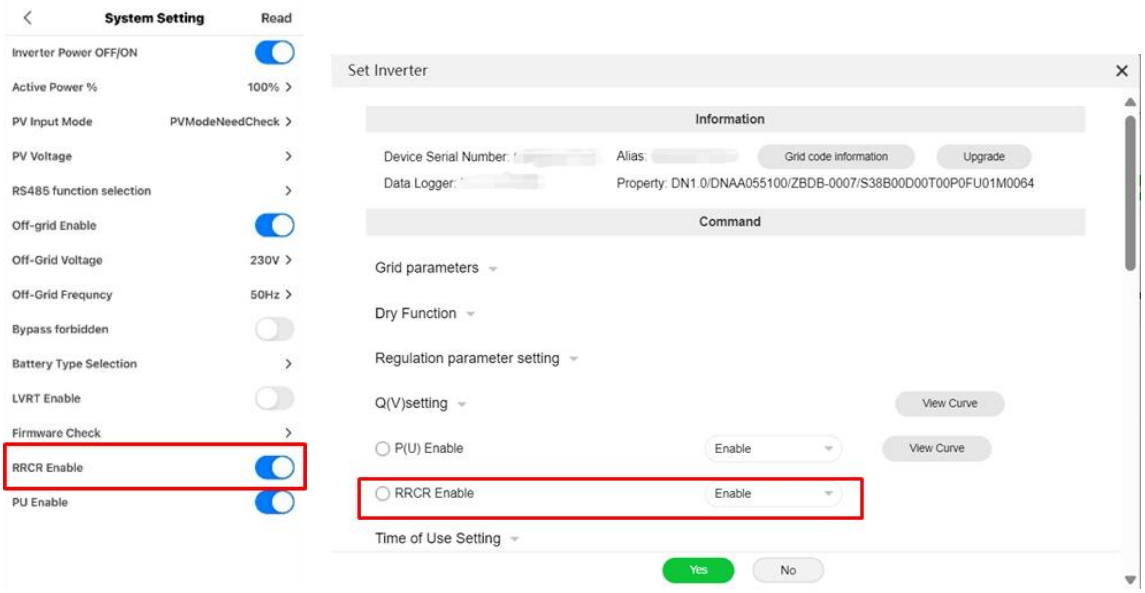
Pin	Description	DRMs Power Control
1	DRM5	0%
2	DRM6	30%
3	DRM7	60%
4	DRM8	100%
5	Ref/Gen	/
6	COM/DRM0	standby
7	/	/
8	/	/

Picture 10: Connection of RRCR with RJ45 communication port

Caution: Excessive voltage can damage the inverter! External voltage of DRM port doesn't over +5V.

How to enable and disable RRCR function

The RRCR function can be enabled and disabled through Growatt online installer platform Growatt OSS and local configuration APP ShineTools.



Picture 11: Setting on ShineTools (local) and OSS platform (remote)

Please confirm that the inverter and ShineTools are the latest FW version.

Priority of energy management functions

Additionally, there is other 2 different energy management requirements beside DRMS/RRCR control used in inverter operation:

a. *Export limitation: limitation of electrical power amount exported (sent back) to the grid. This value is mostly aligned with grid distributor.*

b. *VPP function: Virtual Power Plant, which is usually used for grid balancing and frequency regulation, peak shaving or centralized control……*

In some scenarios, some or all these energy managements may exist in one system at the same time. In this case, Growatt inverter will ensure the DRMS/RRCR control and export limitation function as the highest priority. The inverter will perform the lower value of DRMS/RRCR demand and export limitation firstly, and then if there is VPP control, the output power can only be adjusted within that limitation.