



ZERO EXPORT & POWER MANAGEMENT

What is Zero Export & Power Management?

It simply means
“NO POWER EXPORT TO GRID”

Solar energy supplies the local load instead of the public utility by monitoring / limiting the voltage and current as per the load requirement.

Zero Export device will monitor & then accordingly Inverter can generate the same unit or less unit than the load.

Requirement-

- In India where net metering is required, sometimes local DISCOM provide the facility in 6-8 months. Due to uni-directional meter available on site, it pays a lot of cost to the client because of extra un-used units generated on site. Therefore, clients prefer to go with zero export device.

reliability

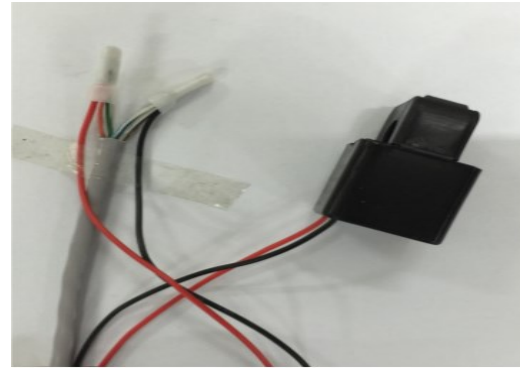
✓ Right System Design

ELECTRICAL DESIGN

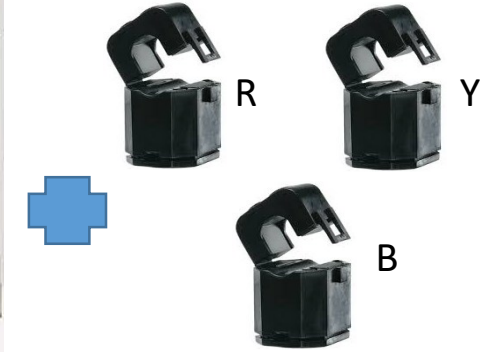
Zero Export & DG-PV Management

- ❖ Zero Export Device required for restricting export to Grid where no Net Metering is available
- ❖ DG-PV Synchronising Control Panel is required to ensure no push back of power to DG Set

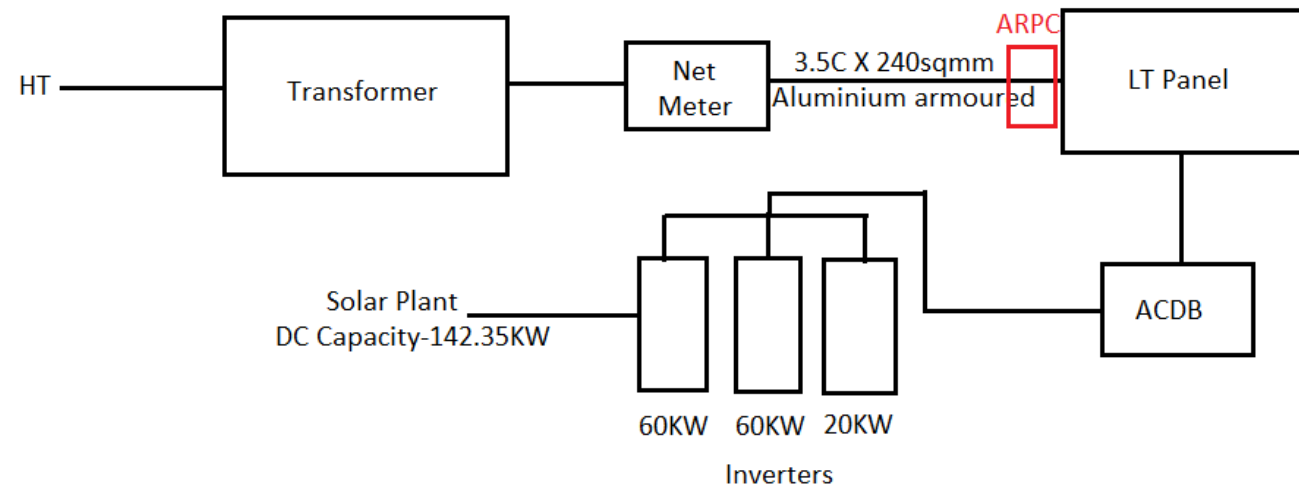
Zero Export Solutions for Enviro GTi Inverters



ZERO EXPORT DEVICE FOR 1-Ø INVERTERS



ANTI REVERSE POWER CONTROLLER (ARPC) FOR 3-Ø INVERTERS



Zero Export CT/ ARPC is always installed between LT Panel & Net Meter/ Transformer

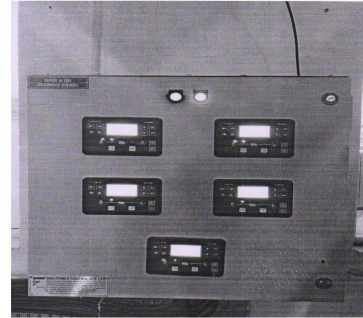
reliability

✓ Right System Design

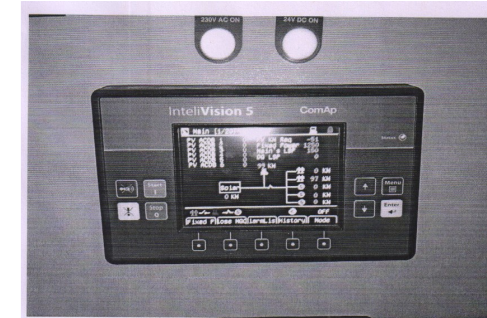
DG-PV Synchronising Panel for Grid Tie Inverters

ELECTRICAL DESIGN

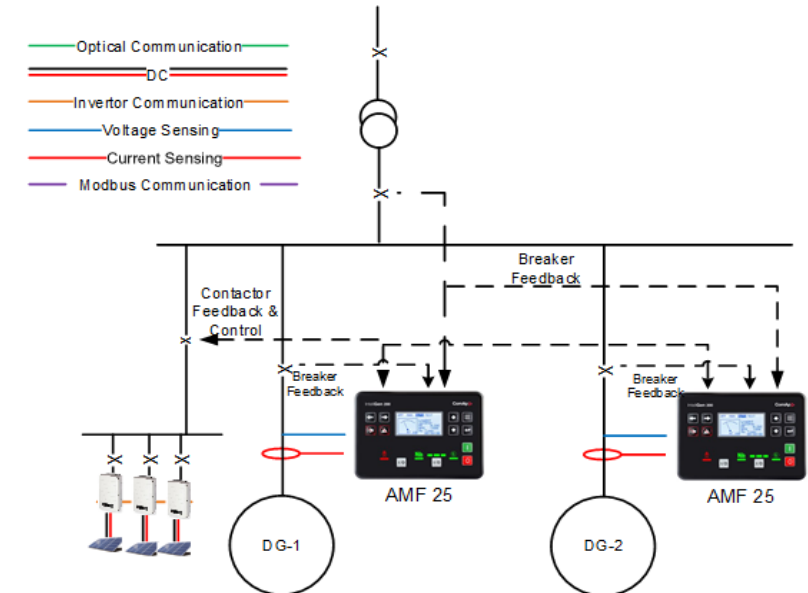
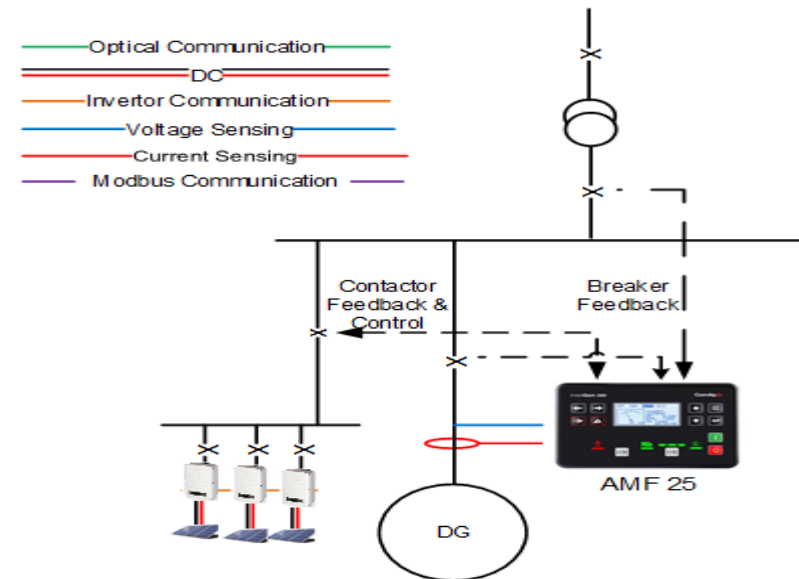
- To Run the Solar Plant in synchronization with DG Set when Grid is not available
- To restrict “Push Back” of Solar PV to DG under low load conditions
- Ensure Solar Power share to Load does not exceed 30% of DG rated output under low load conditions
- The DG PV management system can also be expanded for enabling Zero export to Grid in larger PV Plants



Slave Controller Panel



Master Controller Panel



Schematics of DG-PV Sync System

Inputs required from End customer/Dealer/System Integrators for Zero Export-

- System configuration of the Plant (Solar DC Capacity).
- Incoming cable size from Net Meter/Transformer to customer's LT panel.
- Existing CT rating and its ratio .
- Connected Load of the site.
- Distance from Inverter to meter.
- Electrical SLD of Plant.

Zero Export Device for Single Phase

In Havells GTi Single Phase Inverters, zero export facility is in-built, Current Transformer (CT) is to be installed externally.

Single Phase Inverter range is given below-

Model-

- Enviro GTi1100NG
- Enviro GTi2200NG
- Enviro GTi3000NG
- Enviro GTi5000D

What is Current Transformer?

A **Current Transformer** (CT) is a type of transformer that is used to reduce or multiply an alternating current (AC). It produces a current in its secondary which is proportional to the current in its primary.

Uses-Current transformers are the current-sensing units of the power system and are used at generating stations, electrical substations, and in industrial and commercial electric power distribution.

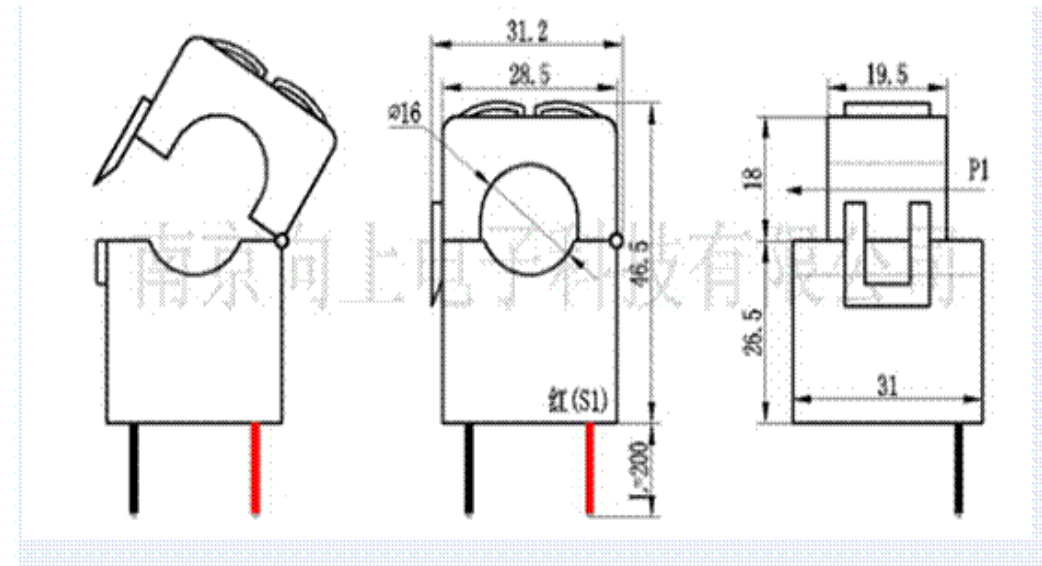
Applications-

Measuring current metering, protections, Controls, Isolations, etc.



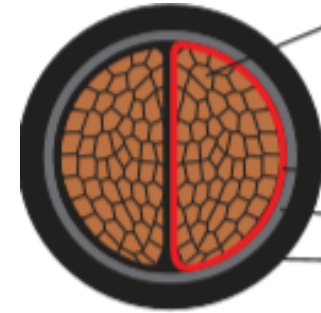
Zero Export Device for Single Phase

- The standard CT which comes with zero export device is Split Type of **150Amp, 16 mm dia only**.
- Zero Export Device in-built into Single Phase Inverter can take maximum **150Amp current only**.
- In Single Phase system, we can go for zero export for **connected load upto 5KW & cable from LT Panel to net meter dia should be less than 16mm**.
- We have to connect CT with Inverter through **Ethernet cable** to enable zero export of the system.



Cable Size in Single Phase System

- Current Transformer is placed in cable from LT Panel to Net Meter.
- Generally cable in single phase system from LT Panel to Net Meter is of **2CX4sqmm/6sqmm XLPE Un-armoured**.
- From table we can observe that upto 2C X 16sqmm, overall dia is 14mm, so we can use Havells Std. Current Transformer 150Amp, 16mm dia.
- **NOTE-** It is recommended to advise Installer to check cable size on site as in many sites cable tapings are there which increase cable dia and results in failure of CT fittings.



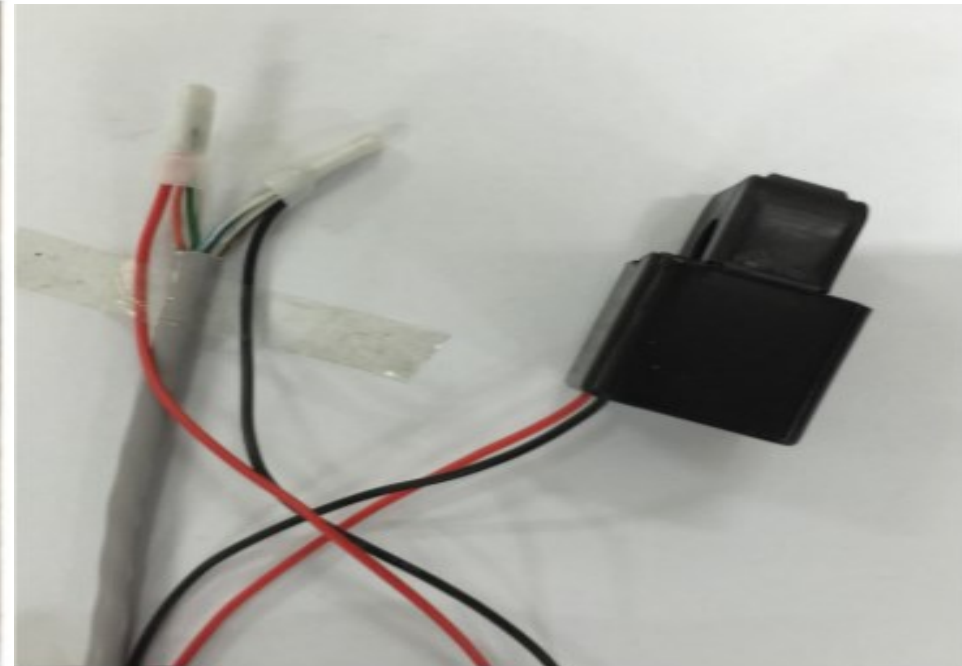
2C XLPE Un-armoured cable

Size (Cross Sectional Area)	Approx. Overall Dia of Cable
Sqmm	mm
4	12
6	13
10	15
16	14

Zero Export Device for Single Phase

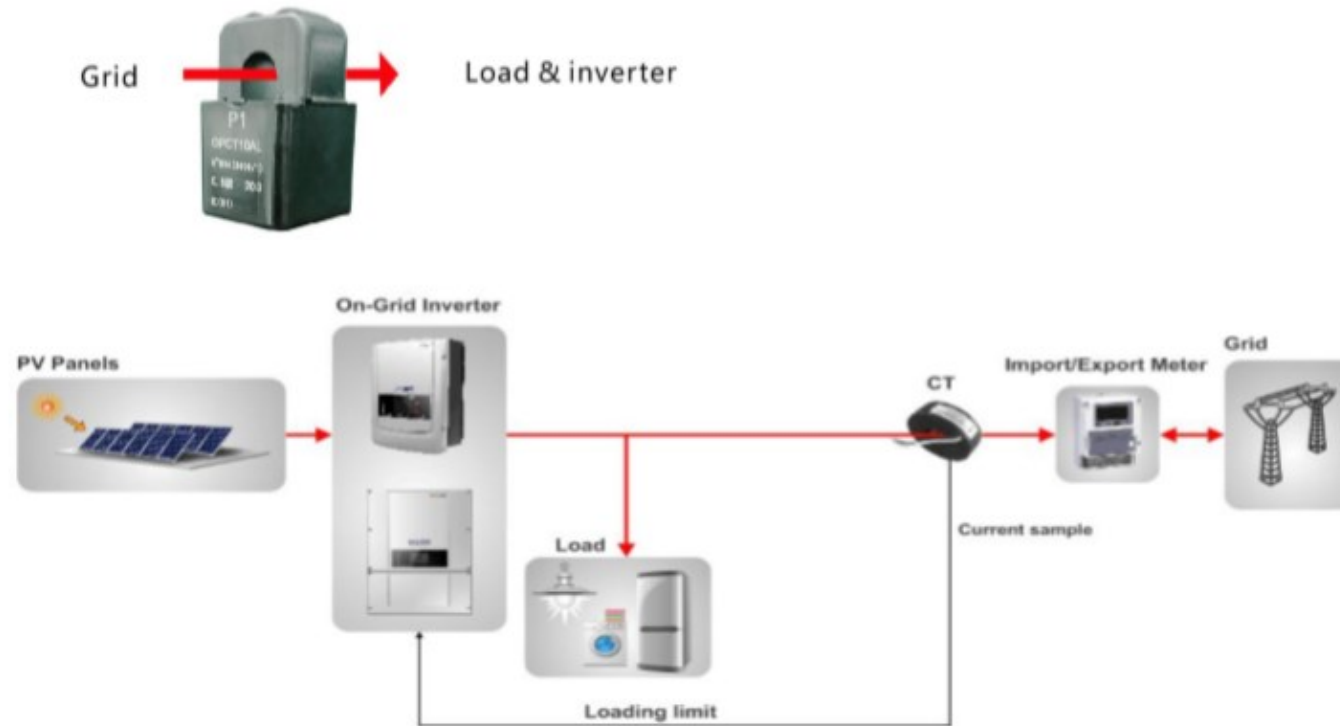


Current Transformer



Current Transformer connection with Ethernet cable

Zero Export Device for Single Phase



Anti-Reverse Power Controller for Three Phase

Operation Principle:

- ARPC will detect grid voltage on R,Y,B input and current on CT, the CT are connected before the local load input.
- The ARPC can calculate the reverse power by voltage and current.
- In case local load power is less than solar inverter power, then there will be reverse power detected on ARPC. ARPC will give the command to the string inverter by relay output to inverter IN1, IN2, IN3, IN4.
- The IN1, IN2, IN3, IN4 on/off status determines the inverter output power, in this way, inverter will decrease its power till there is no reverse power on ARPC (zero export.)



Anti-Reverse Power Controller for Three Phase

- In Three Phase System, we have to install **Zero Export Device** which is called **Anti-Reverse Power Controller with Current Transformer per phase**.
- We can use ARPC with connected load provided per phase current rating should be upto **150Amp & cable dia of R, Y, B per phase conductor should less than 16mm** provided there is no DG on site.
- We will supply our Std. CT of 150Amp current rating 3 nos total.



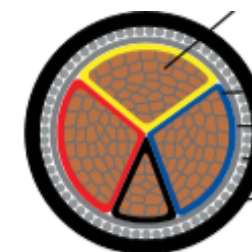
ARPC have four nos of inputs.

Anti-Reverse Power Controller for Three Phase

- Pls Note- ARPC in 3 phase can be installed maximum upto 100KW. If DC Capacity is more than 100KW then customer needs customized ARPC which can support secondary current 5Amp.
- Second option is customer can use regular Std. ARPC with CT ratio 1000:1 as ARPC supports current transformer ratio (secondary)- 0-1A.
- In this case Havells will suggest Current Transformer rating to Installer to buy from the market as per the customer's sanctioned load.
- Pls Note- For customized Zero Export Device may take 6-8 weeks to deliver.

Cable Size in Three Phase System

- Generally cable in three phase system from LT Panel to Net Meter/Transformer is of **3.5C / 4C XLPE armoured**.
- From table we can observe that upto 3.5C X 150sqmm, overall dia is 44mm, so we can use Havells Std. Current Transformer.
- $(44/3.5 = 12.5\text{mm})$ Therefore, we can use three nos of CT, one CT per phase.
- **NOTE-** It is recommended to advise Installer to check cable size on site as in many sites cable tapings are there which increase cable dia and results in failure of CT fittings.



**3.5C XLPE
armoured cable**

Size (Cross Sectional Area)	Armoured
	Approx. Overall Dia of Cable
Sqmm	mm
3X25 +16	23
3X35 +16	26
3X 50+25	28
3X70+35	33
3X95 +50	36
3X120+70	40
3X150+70	44

Equipment required & Scope in Three Phase

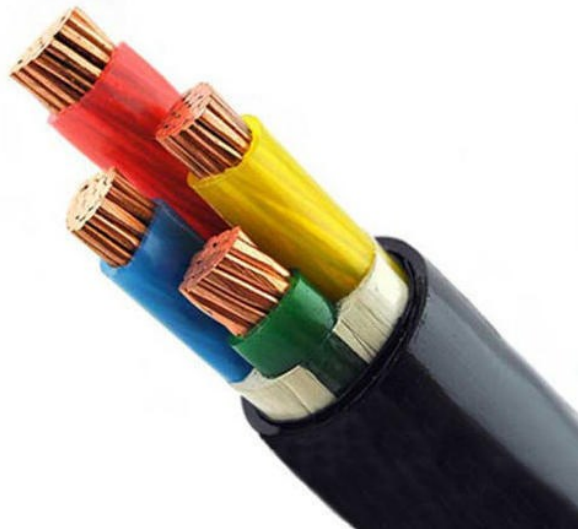


Anti-Reverse Power Controller (ARPC)-
Havells scope.



Std Split Type Current Transformer-Havells
scope, Customized CT- Installer's scope.

Equipment required & Scope in Three Phase

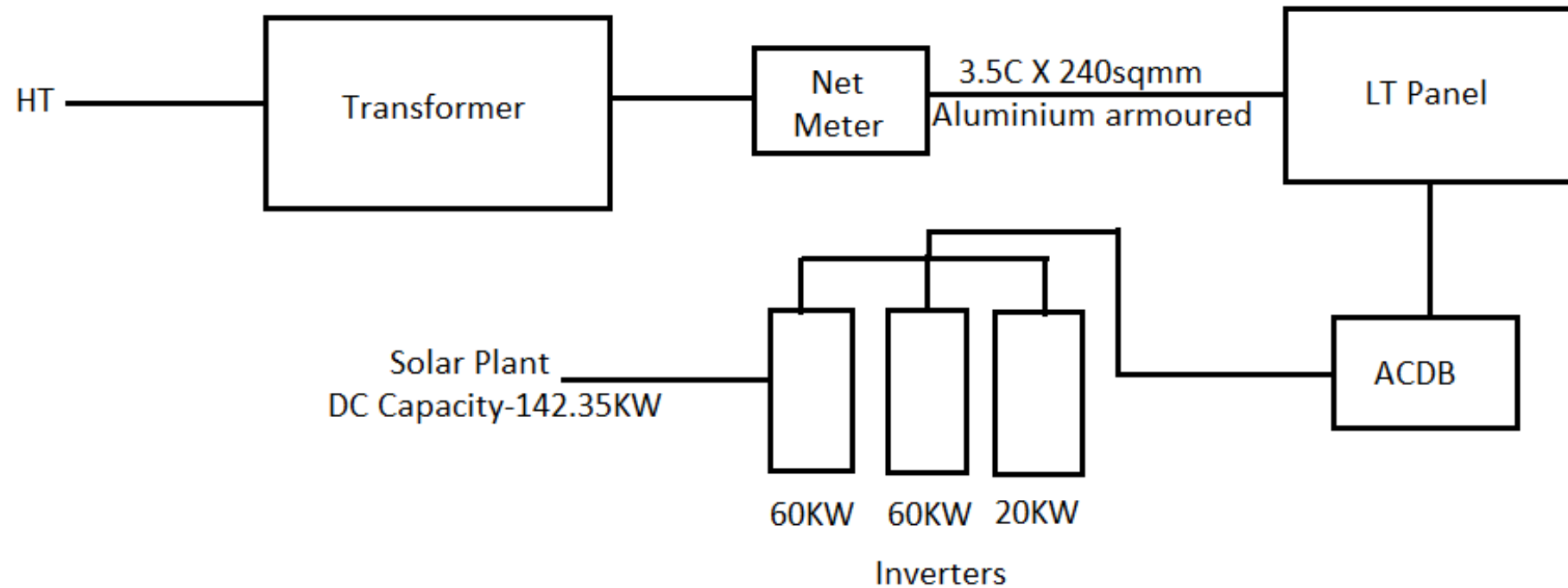


From ARPC to R,Y,B
Phase-Voltage cable,
Cable section 2-4 Sq
mm- **Installer's
scope.**

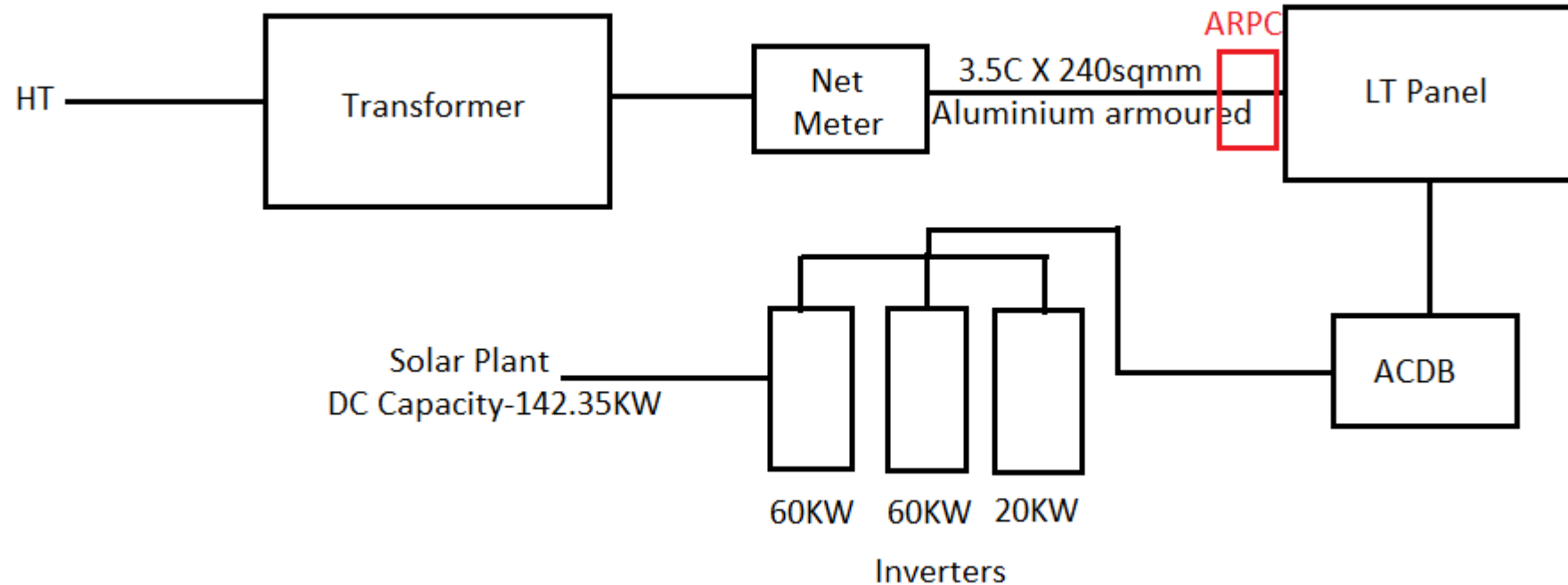


- From ARPC to CT-CT Cable, twisted shield Ethernet Cable – **Installer's scope.**
- From ARPC to Inverter- Load limiting cable, twisted shield Ethernet Cable – **Installer's scope.**

Case Study

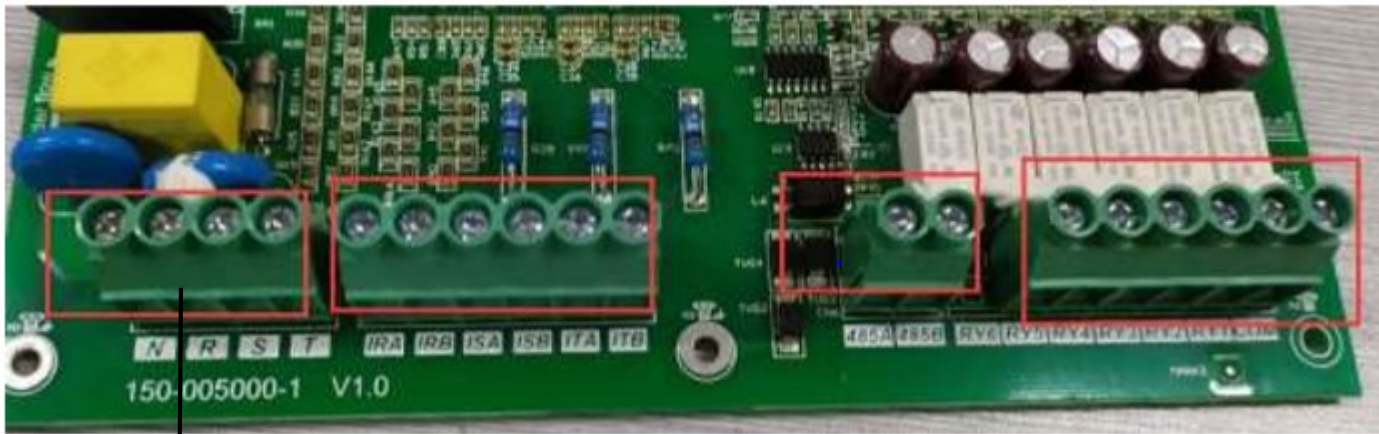


Case Study

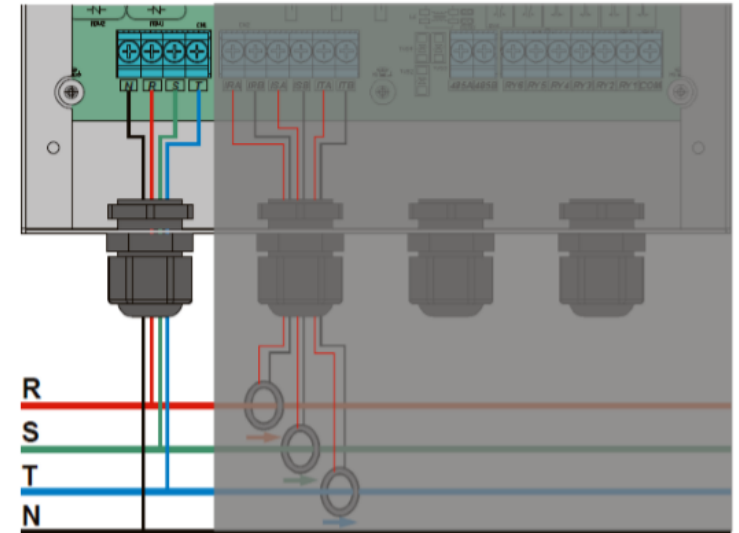


Pls Note- ARPC is always installed between LT Panel & Net Meter/ Transformer

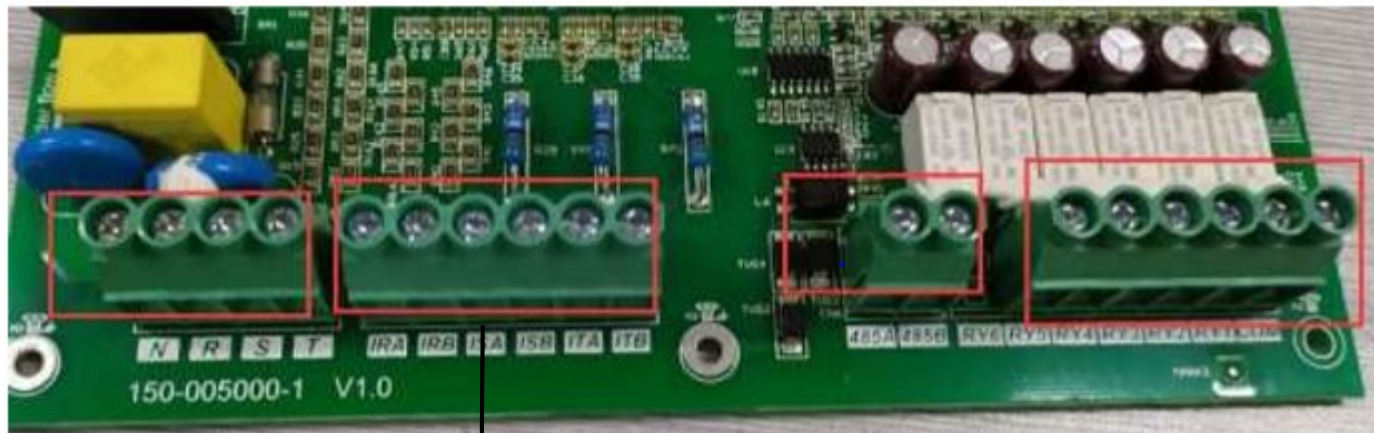
Case Study



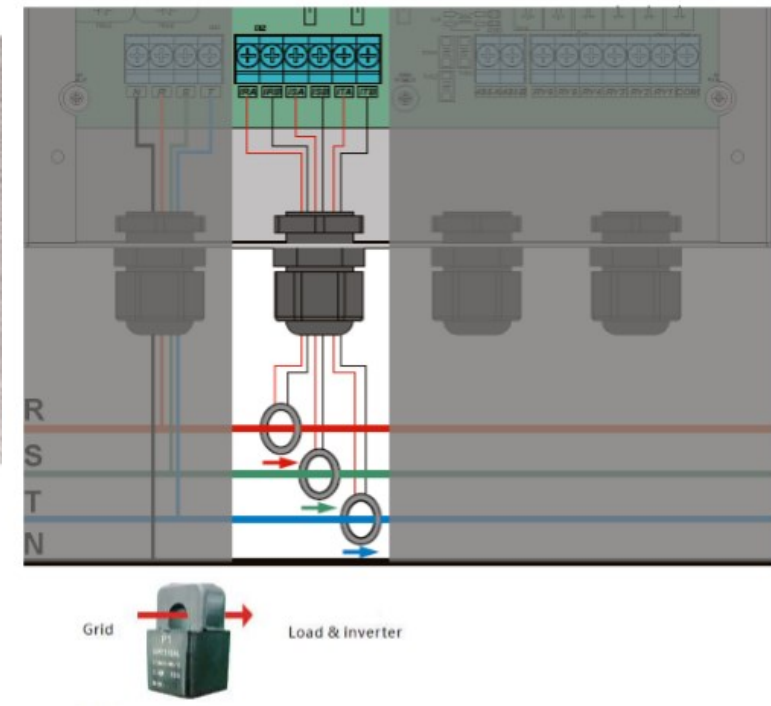
ARPC to R,Y,B phase for voltage reference-
4sqmm copper cable



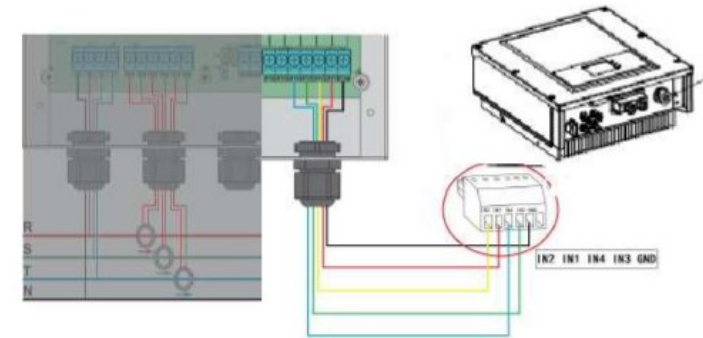
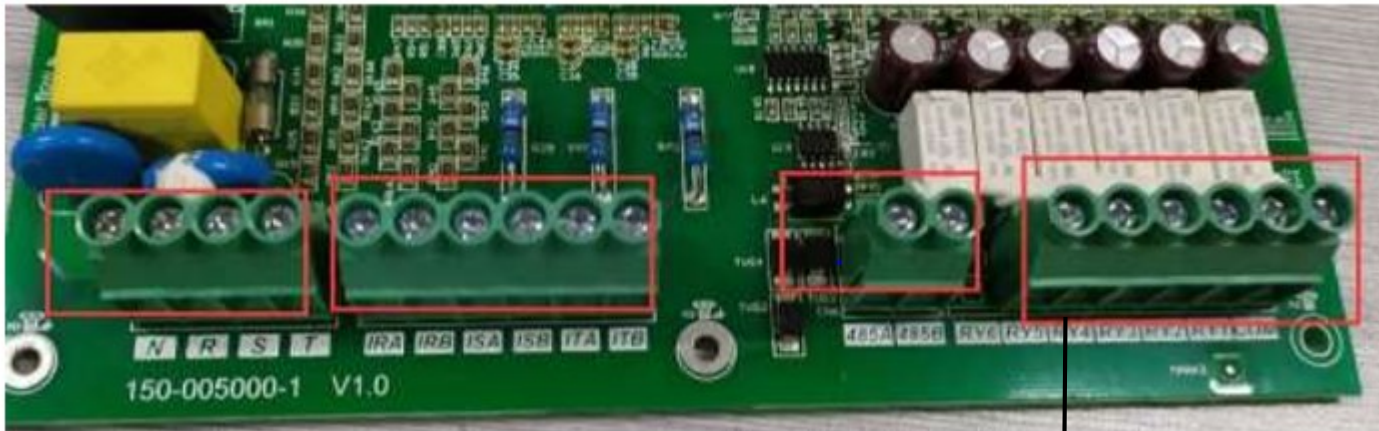
Case Study



ARPC to CT- Ethernet cable for current signal.

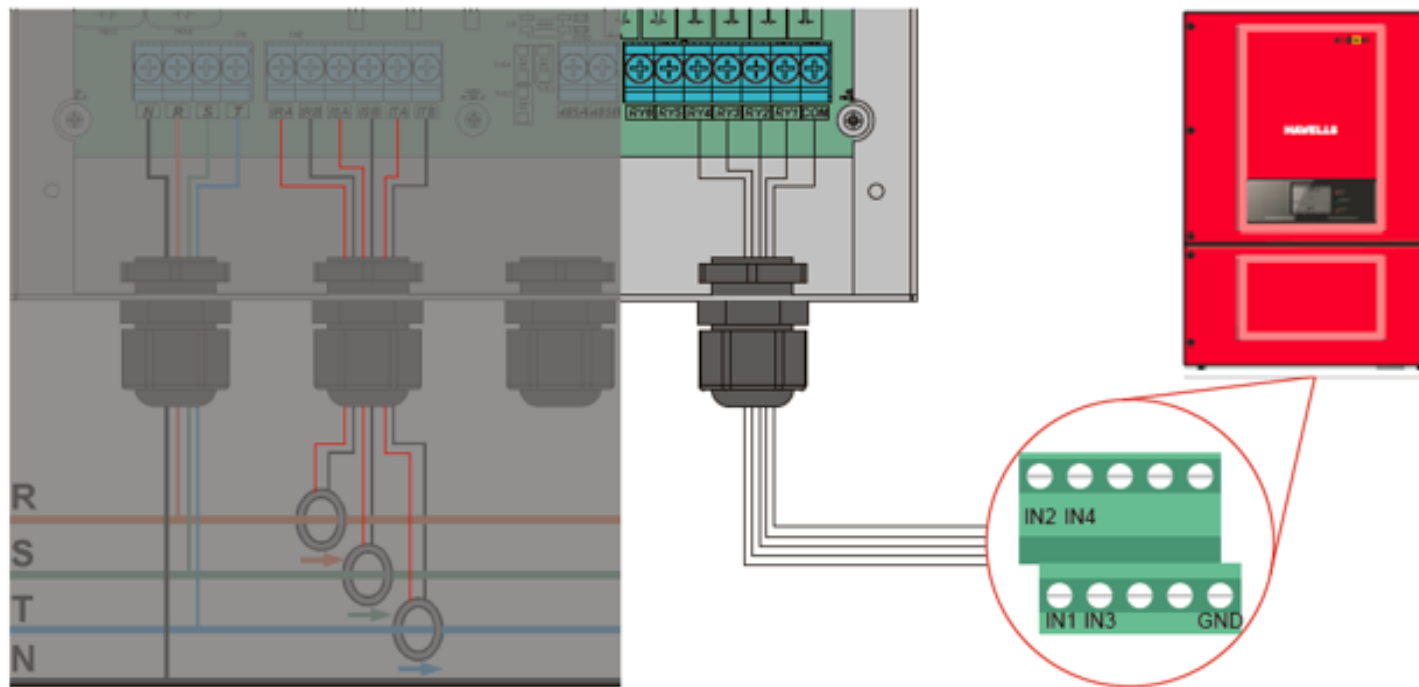


Case Study

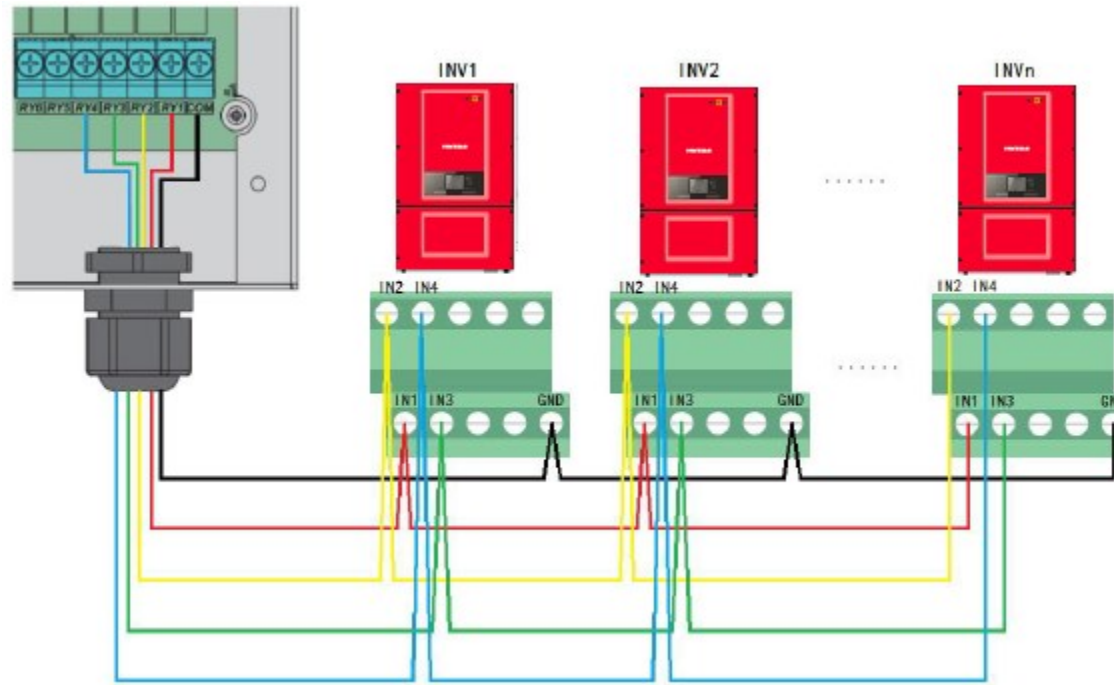


Inverter to ARPC Cable – Ethernet cable

Case Study

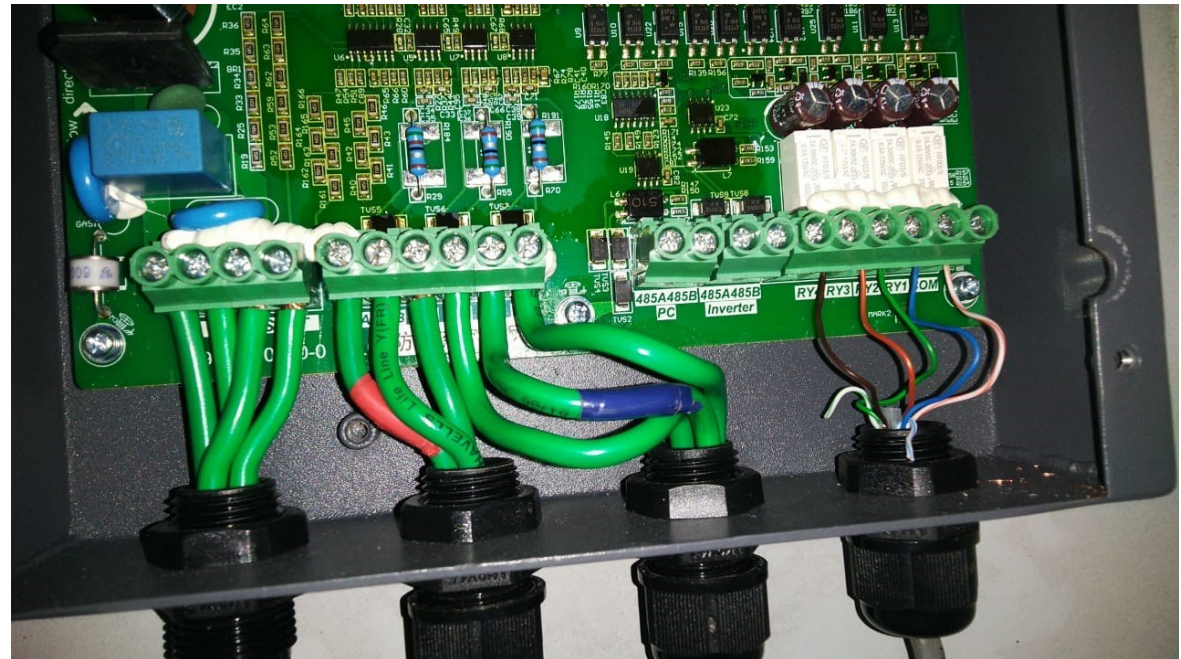


Case Study



If there are multiple Inverter, then we have to loop ARPC & all Inverters with Ethernet cable.

Case Study





DGPV POWER MANAGEMENT

WHY WE REQUIRE DG PV SOLUTION?

- To Run the Solar Plant in synchronization with DG when Grid is not available to restrict the back feed (Push back) of solar Power to Genset and to maintain the DG on 30 % load.

EXAMPLE : A factory having Connected Load = 600 KW

Solar Plant Capacity = 500 KW

DG Rating – 600 KVA

CASE 1 : Suppose the Running Load is 400 KW and solar Generation is of 300 KW and DG is operational .

30 % load to be maintained on DG i. e 30 % of 600 KVA = 180 KVA= 144KW (approx. 150kW)

Load shared Solar Plant : $400 - 150 = 250$ KW

AS the extra Energy Produced by Solar $300 - 250$ KWp = 50 KW

To restrict the back feed (Solar Pushback) to DG ,the DG PV management system is required to protect the DG set.

The moto is to save the fuel and Money.

- Zero export and DG control can be done at same time with use of controllers if required.

INITIAL INFORMATION BEFORE SELECTING THE SOLUTION

S.NO	Parameters/points to be checked	Comments
1	Solar power plant capacity(DC)	
2	Inverter Make	
3	Inverter Model Number	
4	Number of Inverters	
5	Total No of ACDB	
6	Communication cable length (Inv to Inv)	
7	Communication cable length (last Inv to Controller)	
8	Number of DG	
9	If more than one DG: DG -DG Synchronization is available on site?	

S.NO	Parameters/points to be checked	Comments
10	If DG-DG synchronization is there: DG Synchronization Solution/Product/Controller available on site.	
11	If DG not Synchronize: is multiple DG running at the same time.	
12	All DG capacity	
14	All DG make and mfg. year	
15	DG C.T availability	
16	Can We use existing C.T of customer for our meter?	
17	Potential free contacts at DG and Grid Input breaker (if no, need to install 230V relay with NO NC contacts)	
18	Please provide SLD if SLD not there please provide hand Sketch SLD.	
19	If DG not Synchronize: is multiple DG running at the same time.	

DG PV Controllers

1. Controllers are used to control the power by sensing the Load from Grid Or DG and correlated to the Power being generated by solar PV plant to ensure that there is no back feed of power to the grid or DG as the case may be.

2. Controllers having the LCD display on it which shows the various parameters .

A) Solar Generation for each ACDB

B) Load on DG

C) Load on Grid

D) Alarm if any fault

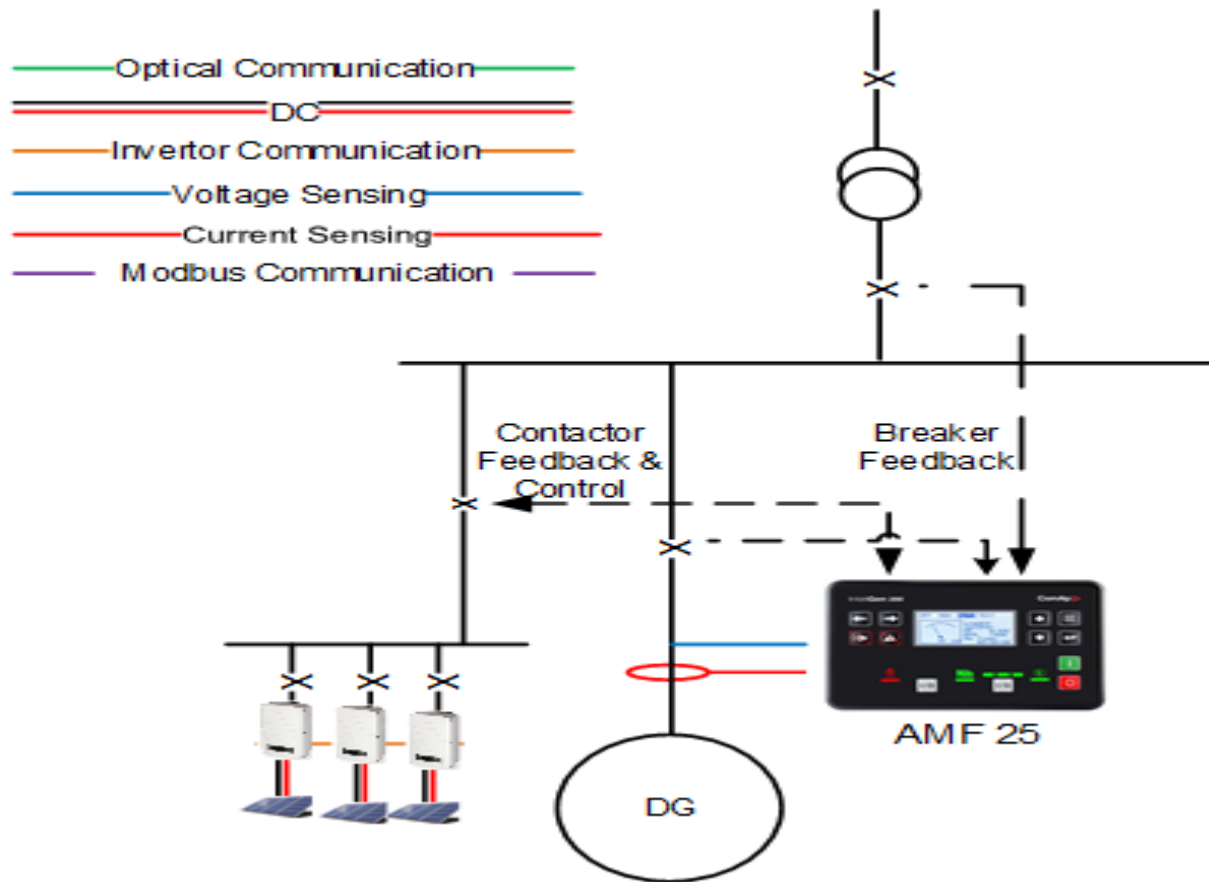


DG PV Solutions- Available

1. Single Step Control with Single DG (up to 100 KWp)
2. Single Step Control with two DG (Up to 100 KWp)
3. Linear Control solution with Multiple DG -16 nos Maximum

DG PV SOLUTION With Single Step Control with Single DG

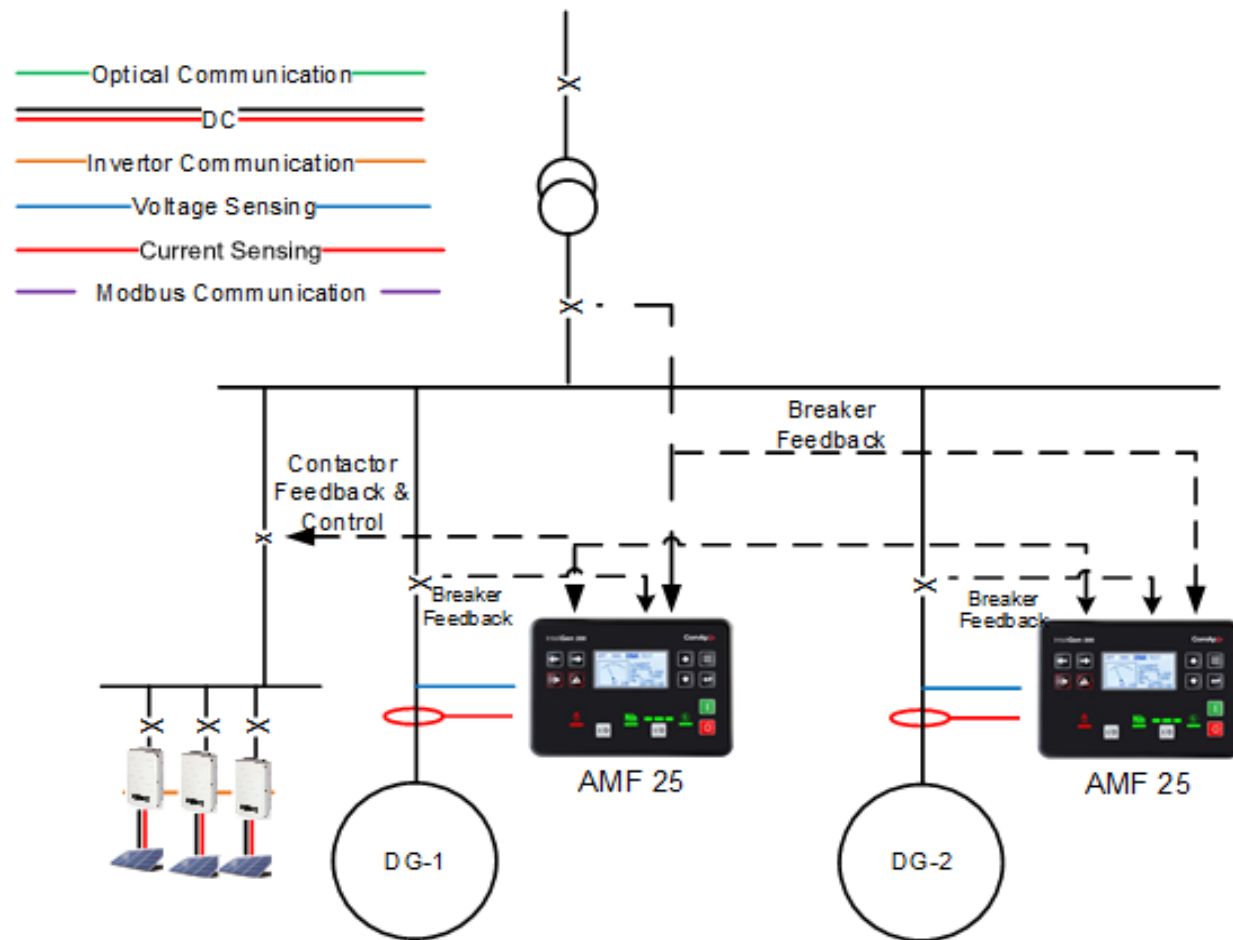
Hybrid Power Plant upto 100 KW with 1 Step Control



Control Philosophy:-

When the GRID power not Available. Operator or Auto System will start the DG & When DG Breaker Close AMF 25 will give the close command to Solar Contactor & solar will continue to Run with DG till DG have minimum 30% load of DG rating as the load go below 30% of DG rating Solar Contactor will open & close again when DG have 45% load.

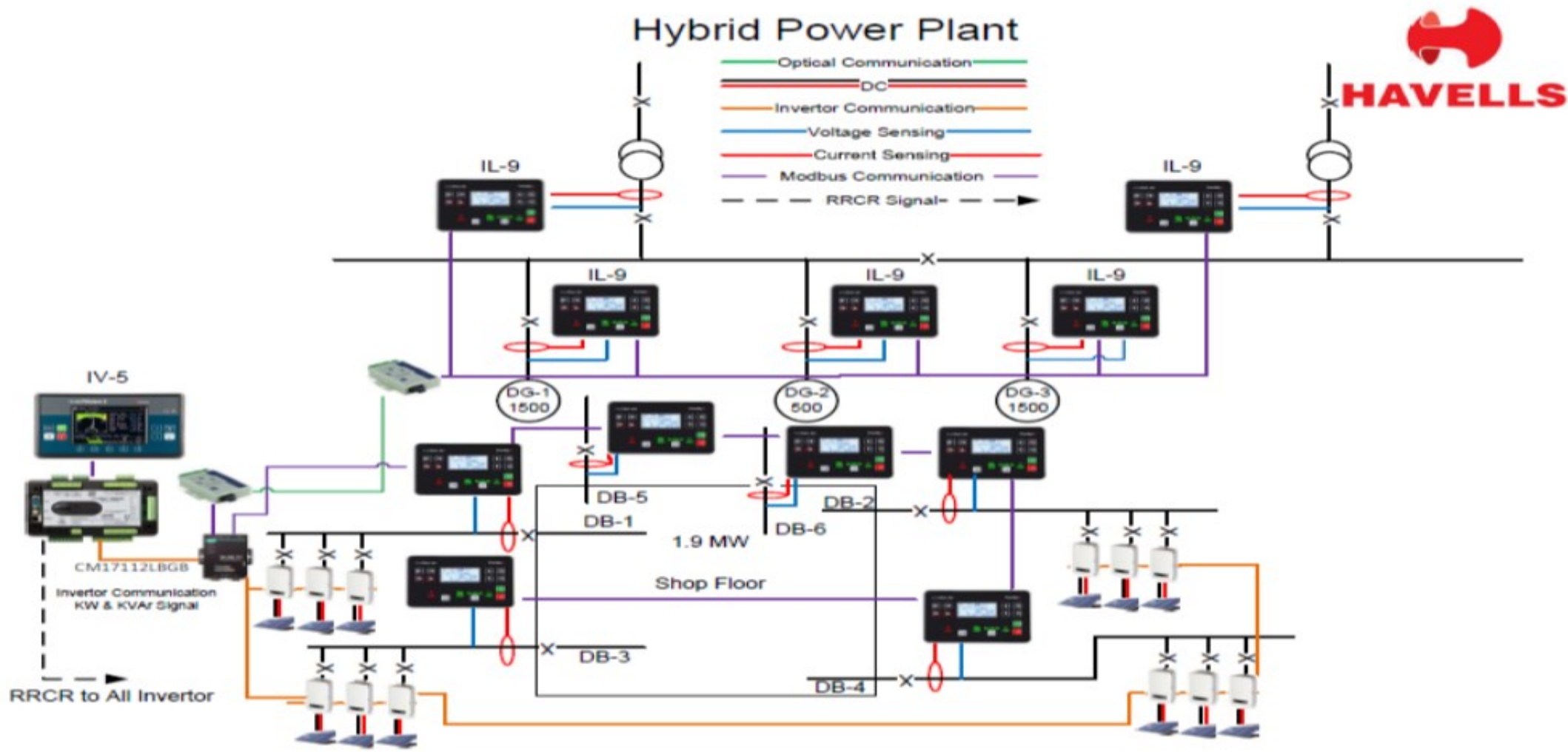
Hybrid Power Plant upto 100 KW with 1 Step Control (Dual DG)



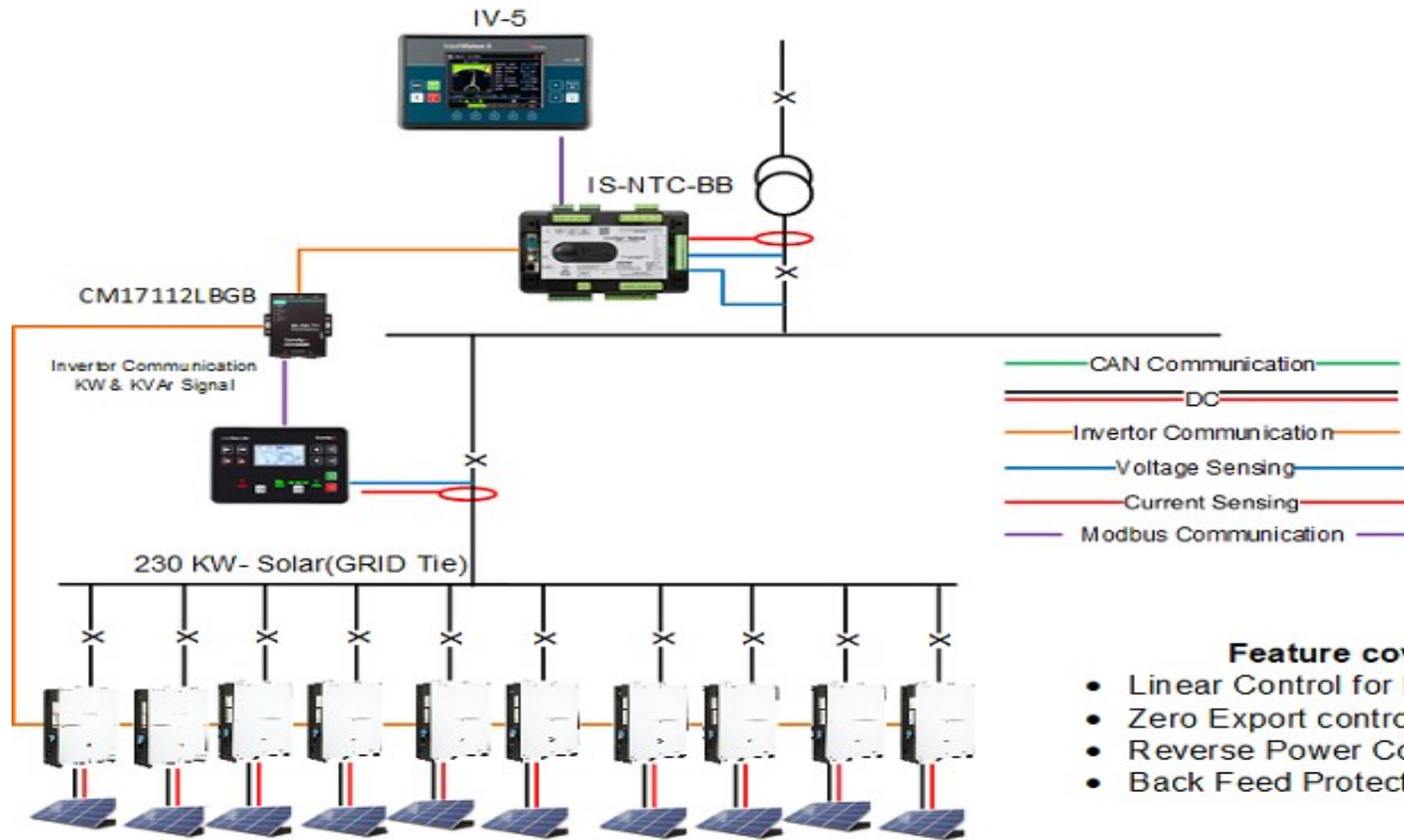
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Zero Export Solution & linear Control with multiple DG



LINEAR ZERO EXPORT & POWER MANAGEMENT



Feature cover with ComAp System

- Linear Control for KW & KVAR.
- Zero Export control
- Reverse Power Control.
- Back Feed Protection

CASE STUDY – GHILOTH PROJECT

1. It is distributed system consisting of total no of 6 ACDBS and differently located at various location with some distance
2. The distance between ACDB'S and UTILITY Plant is 950 meters.
To establish a communication due to higher distance optical fibre used with the help of Converter to convert the light signals into electrical signals.
3. Utility plant ahs 3 nos of DG of 1500 KVA and each DG to maintained at 30 % of the rated capacity.
4. There is two transformers and we have to maintain the Zero export for both the transformers at same time.
5. Control cables are used to get the signal at each breakers of Transformers , DG and ACDB's.



DG PV System installation was done at Havells Plant of Lloyd AC unit at Ghiloth Rajasthan .

The System Comprises of

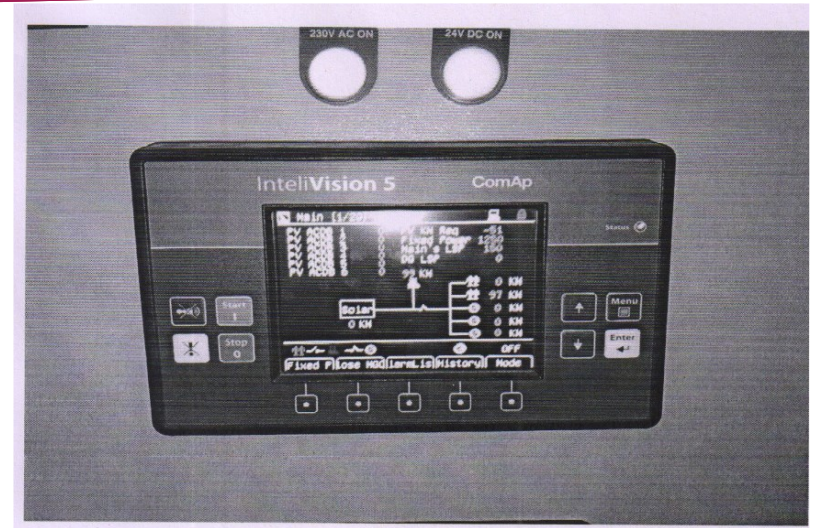
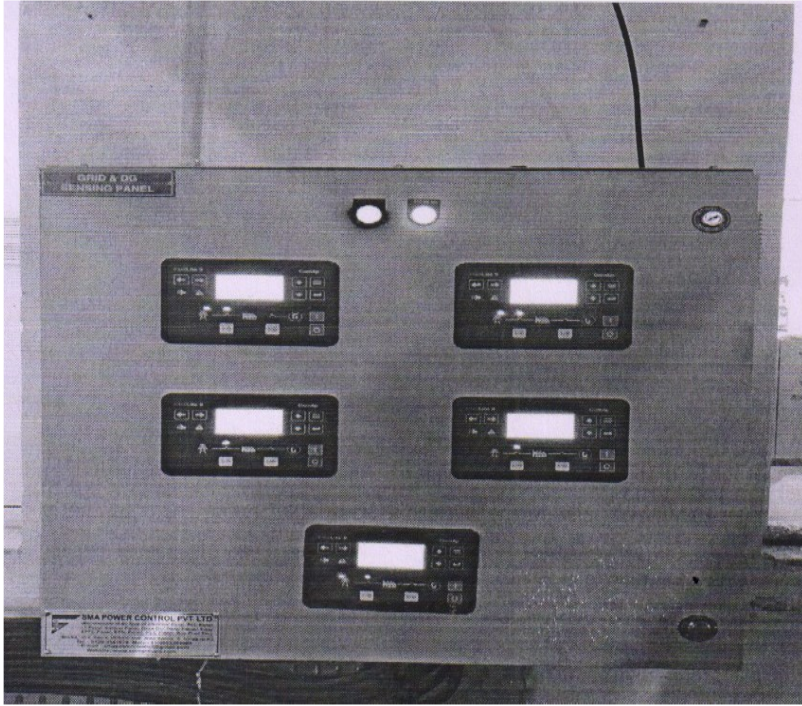
- 11 Controllers
- 2x 3150 KVA Transformer
- 3x1500 KVA DG
- 1.9 MW Solar Plant

The solar Panels are located at factory roof and inverters are placed at production area on a elevated platform at 6 locations.





6 nos of ACDB are located were located at Production area. Each ACDB is having a controller to sense the voltage and current which can be monitored at hybrid Panel Display.

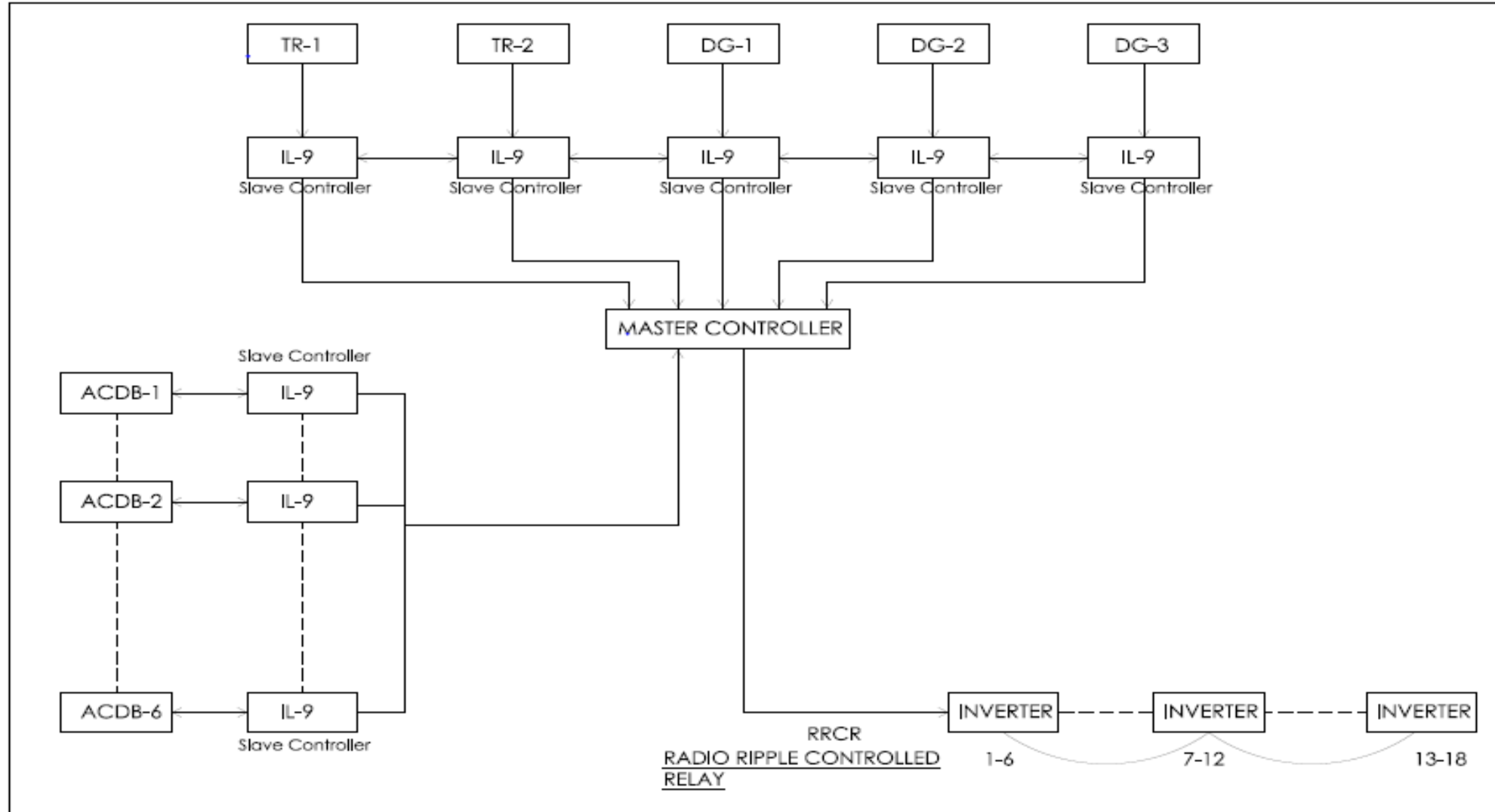


The DG PV main controller shows all the Parameters and real time power generation showing solar is connected with 5 nos of power sources .

(2 nos of transformers and 3 DG)

All sources generating power as per plant demand and feeding to a single bus

BLOCK DIAGRAM



Pls contact if any Zero Export/APRC/DGPV Management related query-

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