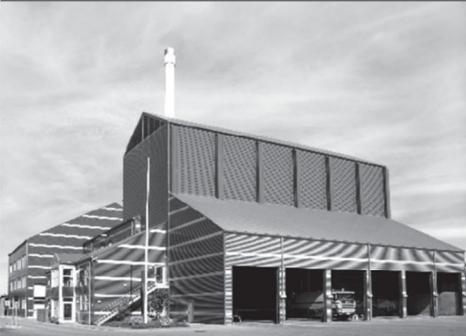




-power in control



ASC APPLICATION NOTES



Inverter Interface

- Interface examples
- Wiring examples
- Communication topology



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1. General information

Warnings, legal information and safety

Warnings and notes

Throughout this document, a number of warnings and notes with helpful user information will be presented. To ensure that these are noticed, they will be highlighted as follows in order to separate them from the general text.

Warnings

 **Warnings indicate a potentially dangerous situation, which could result in death, personal injury or damaged equipment, if certain guidelines are not followed.**

Notes

 **Notes provide general information, which will be helpful for the reader to bear in mind.**

Legal information and disclaimer

DEIF takes no responsibility for installation or operation of the generator set. If there is any doubt about how to install or operate the engine/generator controlled by the Multi-line 2 unit, the company responsible for the installation or the operation of the set must be contacted.

 **The Multi-line 2 unit is not to be opened by unauthorised personnel. If opened anyway, the warranty will be lost.**

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is any discrepancy, the English version prevails.

Safety issues

Installing and operating the Multi-line 2 unit may imply work with dangerous currents and voltages. Therefore, the installation should only be carried out by authorised personnel who understand the risks involved in working with live electrical equipment.

 **Be aware of the hazardous live currents and voltages. Do not touch any AC measurement inputs as this could lead to injury or death.**

Electrostatic discharge awareness

Sufficient care must be taken to protect the terminal against static discharges during the installation. Once the unit is installed and connected, these precautions are no longer necessary.

Factory settings

The Multi-line 2 unit is delivered from factory with certain factory settings. These are based on average values and are not necessarily the correct settings for matching the engine/generator set in question. Precautions must be taken to check the settings before running the engine/generator set.

About the Application Notes

General purpose

This document includes application notes for DEIF's Multi-line 2 unit. It mainly includes examples of different applications suitable for the unit. The document describes in the first part the communication topology possible with different inverter types and manufacturers. In the last part, it describes some of the AC wiring principles.



For functional descriptions, the procedure for parameter setup, parameter lists and so on, please see the designer's reference handbook.

The purpose of the application notes is to offer the designer information about suitable applications for the Multi-line 2 unit.



Please make sure to read this document before starting to work with the Multi-line 2 unit and the genset to be controlled. Failure to do this could result in human injury or damage to the equipment.

Intended users

The application notes are mainly intended for the person responsible for the design and installation. In most cases, this would be a panel builder designer. Naturally, other users might also find useful information in the document.

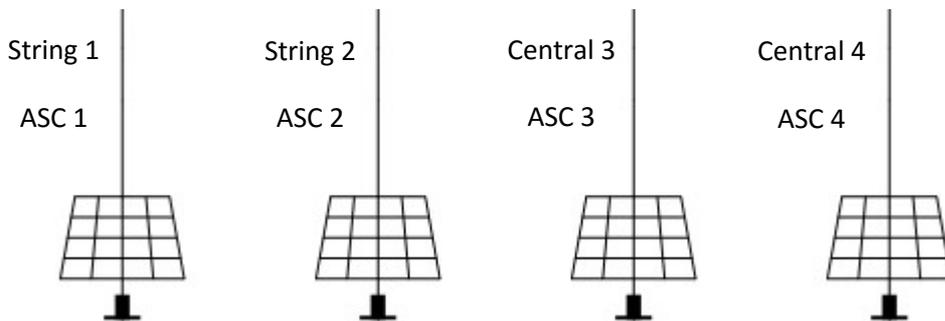
Contents and overall structure

This document is divided into chapters, and in order to make the structure simple and easy to use, each chapter will begin from the top of a new page.

2. General product information

Inverter types

The ASC can be used with string or central inverters. One ASC is required per string of inverters or per central inverter.



Inverter setup (manufacturer-dependent)

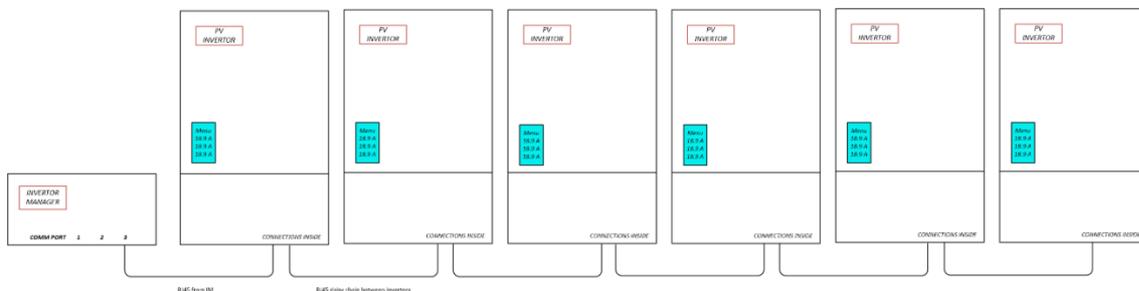
Take notice that in the situations where the inverters need a master inverter, the assignment to become a master inverter needs to be set up through the display of the inverter or through the programming tool or software.

Cable for communication

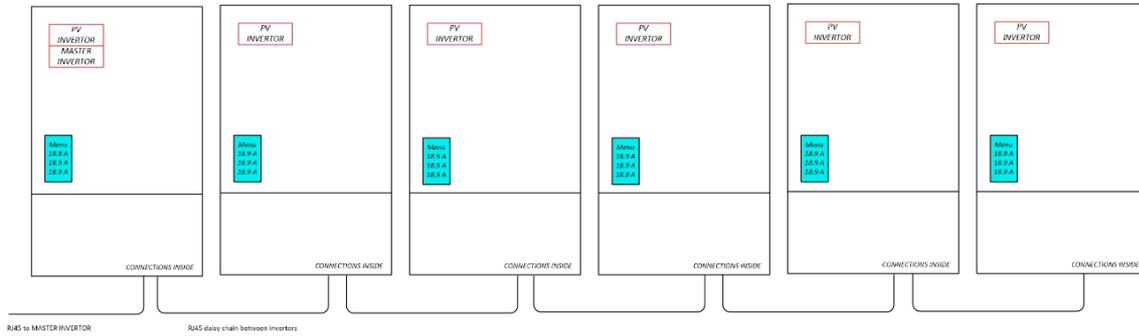
RJ45 connections

Each string inverter usually has an ingoing and an outgoing Ethernet connection.

The Ethernet cables need to be connected in a daisy chain between the inverters. If an inverter manager is part, it must also be daisy-chained.



If only one RJ45 port is available in the inverter, it must be connected to a switch because they must all be linked together to provide control.



Modbus communication

When RS-485 Modbus is used, the Modbus cable is daisy-chained between the components in the system. It can be directly from the DEIF ASC to the inverters or if a Modbus is used, then from the ASC to the Modbus converter.

Use a Modbus communication cable, for example Belden 3105A or similar cable intended for balanced serial communication.

3. Inverter topology

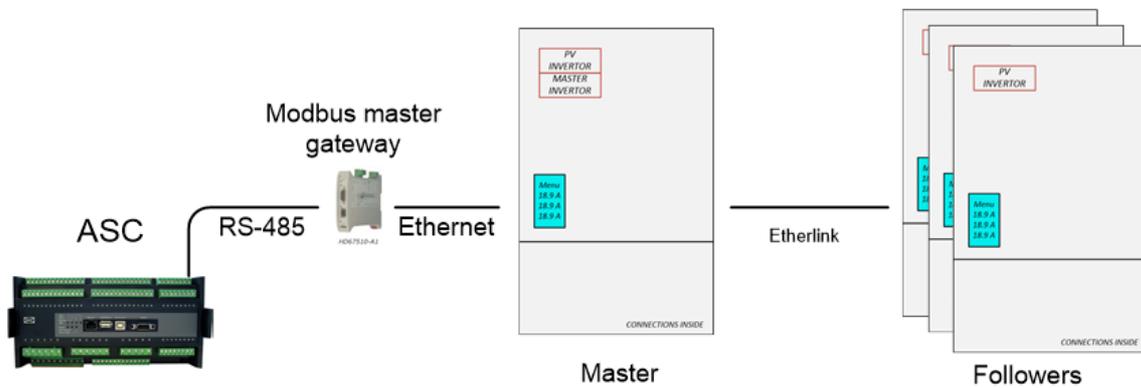
The schematics show how the ASC can be linked to the inverter side. When the Modbus master function is used, the gateway could be needed.

The chapter shows general diagrams for possible inverter interfaces.

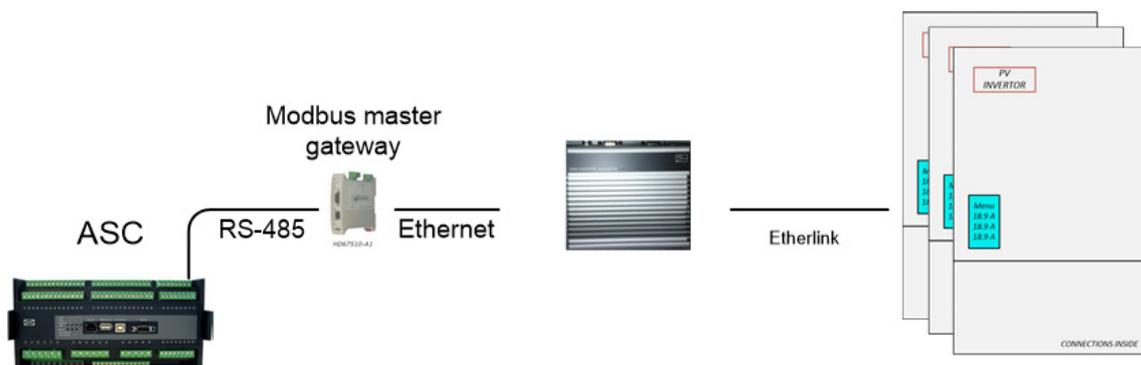
Unicast topology

Unicast vs broadcast may be used if only one inverter is controlled. It means that the inverter communicates back to the ASC and any communication errors may be displayed.

FLX Pro (SMA)

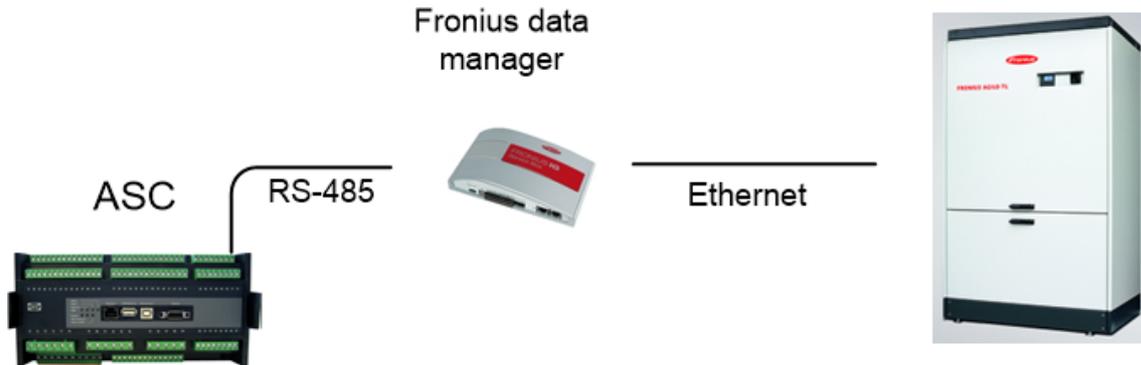


Topology STP 60/inverter manager (SMA)

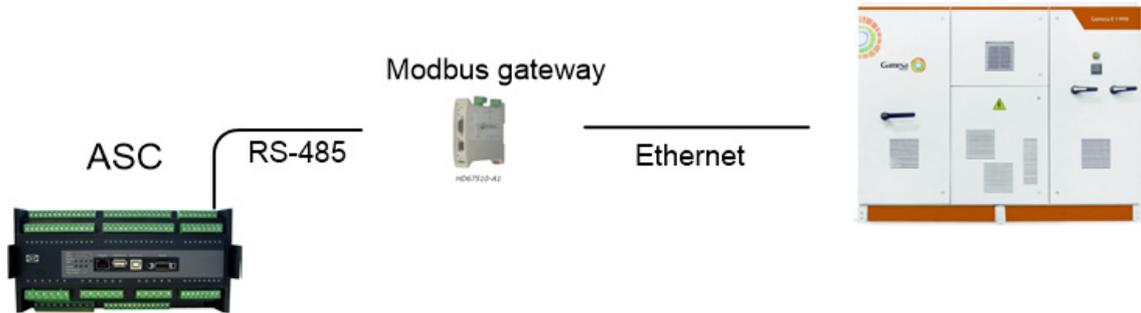


Fronius

This is the topology of communicating to the central inverter or a single string inverter.



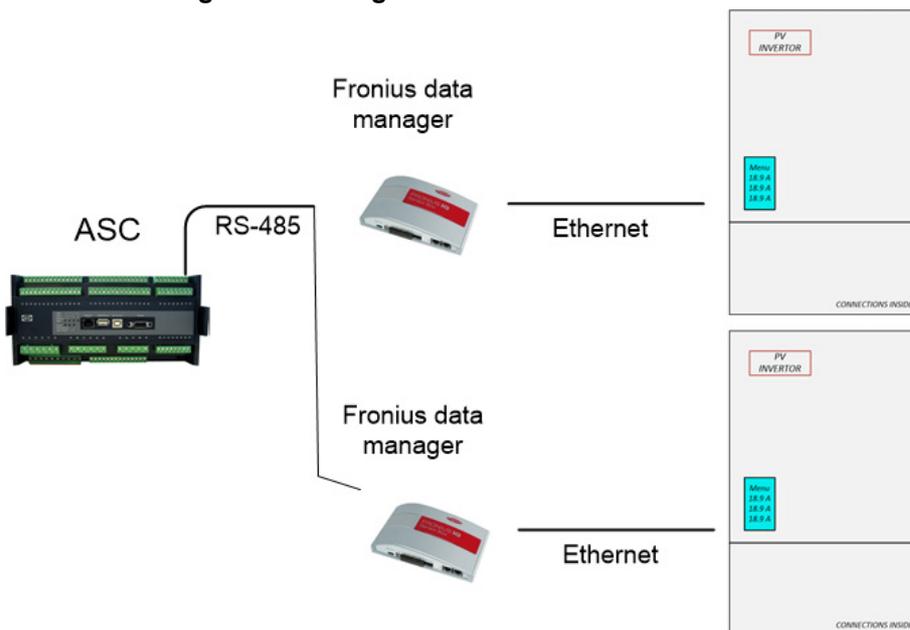
Gamesa E-series



Topology broadcast

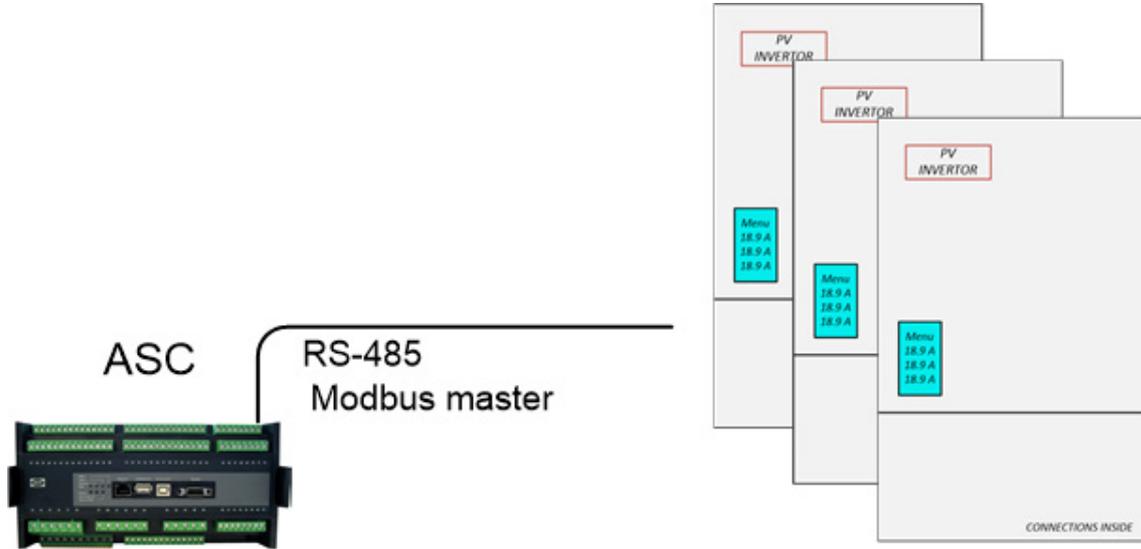
It may be noted that even though the broadcast topology is implemented in the inverter, the unicast communication can be used if only one inverter is present.

Fronius through data manager



Broadcast

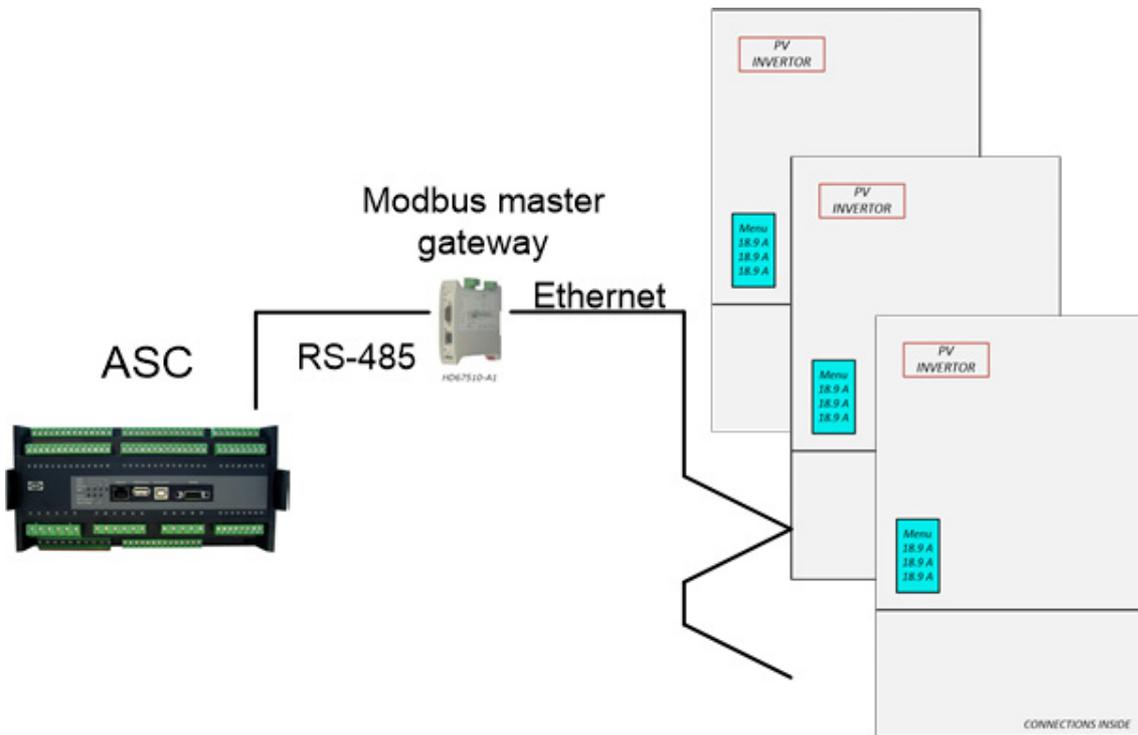
This applies for ABB series, Schneider, Sungrow, Delta RPI, Goodwe, Huawei and others not mentioned but using the RS-485 lines directly.



Broadcast with Ethernet

SMA STP 20000/250000

The ASC communicates to the inverters by the broadcast methodology. The inverters communicate using the Ethernet, so in order to convert the broadcasted to Ethernet, a gateway is needed per STP unit.



Topology monitoring

SMA FSC v1

The ASC communicates to the main controller using TCP/IP communication. The interface unit communicates to the inverters of the system.



Monitoring

For use with protocols where the ASC is not transmitting to an inverter manager or master inverter, the Modbus Ethernet port can be used directly (DEIF OPEN).

Inverter communication topology

In the communication, the ASC can serve as either a master device communicating to the inverters directly or through a gateway device or a slave device where a fuel-saving controller is controlling the inverters. The standard communication is following the SunSpec protocol.

A dedicated menu for selecting the PV protocol is added:

- Menu 7561 "PV protocol"

Furthermore, the following settings are added in order to offer a flexible interface and comply with the inverter(s). All settings relate to protocols where the ASC acts as a master:

ASC Menu	Setting	setting
7562	Tx write type	Unicast/broadcast
7563	Tx maximum rate	for ex. 1000 ms
7564	Tx function code	0x06h or 0x10h

Tx write type

Two selections can be chosen; Unicast and Broadcast.

Unicast

Unicast is used in point-to-point interfaces. This means in systems where the ASC communicates to one inverter/communication device only. All write commands from the ASC is performed to the ModbusID selected in menu 7511, and a response to the write request will be transmitted from the inverter/communication device.

Communication supervision is possible and a communication alarm can be raised in case communication is compromised.

Operating status of the inverter can be taken into account by the ASC. This is for instance “stopping inverter” or “inverter ramping”.

P and Q references will be based on the rated size received/read from the inverter/device.

Broadcast

Broadcast is used in interfaces with multiple inverters/devices where the ASC itself needs to control them all. The ASC will in this case not address each inverter directly with a command and await the response before applying the same command to the next inverter and so on. Instead, it will broadcast the commands to all inverters. The reason for this is to obtain satisfying control speed. The response is not considered mandatory as the ASC will continuously transmit the commands.

Communication supervision is not possible and a communication alarm cannot be raised in case communication is compromised.

Operating status of the inverter cannot be taken into account by the ASC because the inverters do not feed back status information to the ASC

Broadcast initialisation

Some protocols (SunSpec) may have an initialisation routine where the ASC outlines the implementation in the inverter. This routine will be performed on the inverter holding the ModbusID selected. Afterwards, the ASC will switch to broadcast. When Broadcast is selected, the ASC will use broadcast ModbusID0 in all write commands despite the actual setting of the ModbusID.

During the initialisation routine, communication supervision is possible and a communication alarm can be raised in case communication is compromised.

P and Q references will be based on the rated sizes set in the ASC. ASC-rated setting menus have been expanded to include rated Q as well. The rated P and Q will need to be set to match the actual rated sizes of the total inverter installation.

Tx maximum rate

Here it can be selected how fast the ASC is allowed to transmit. The setting is added as some inverters cannot take in too much communication, and rates of 1-2 seconds can be used.

Tx write function code

Here it can be selected whether write commands are to be done using single register write (0x06) or multiple register write (0x10). Depending on protocol using multiple register write (0x10) may be faster (less telegrams needed). However some inverters only support 0x06h.

4. Configuration, setup and connections

ASC Modbus setup

The following values needs to be set up in the ASC:

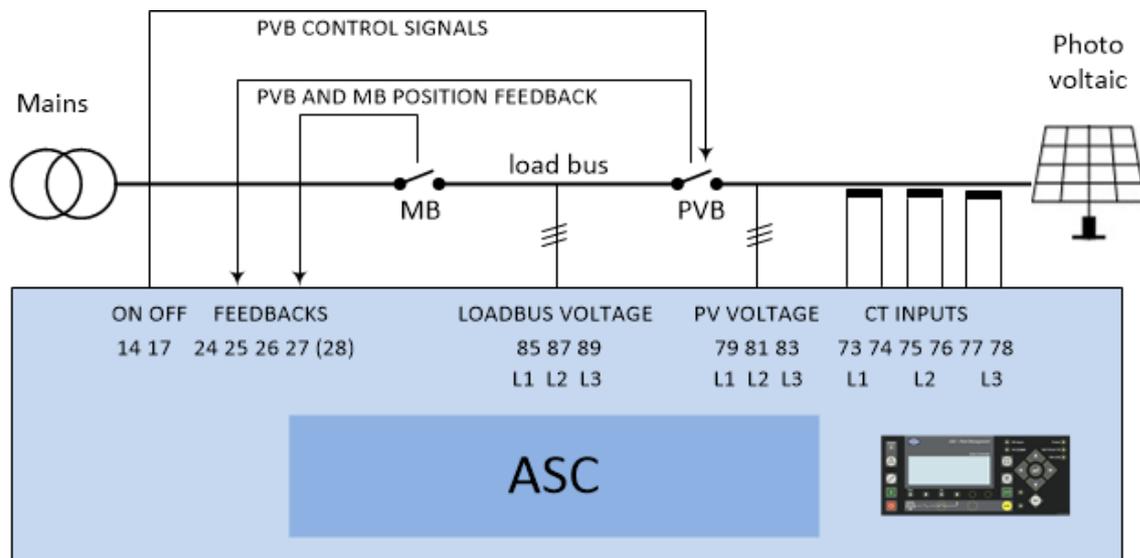
Ext. comm. ID	
Description:	Configuration of external communication ID number
Setpoint:	<input style="width: 100px;" type="text" value="1"/> (1 .. 247)
Ext. Comm.Speed	
Description:	Configuration of external communication speed
Setpoint:	<input style="width: 100px;" type="text" value="19200 Baud"/>
Ext. Comm. Mode	
Description:	External communication selection. RTU/ASCII or profibus.
Setpoint:	<input style="width: 100px;" type="text" value="RTU"/>

DEIF ASC AC connections

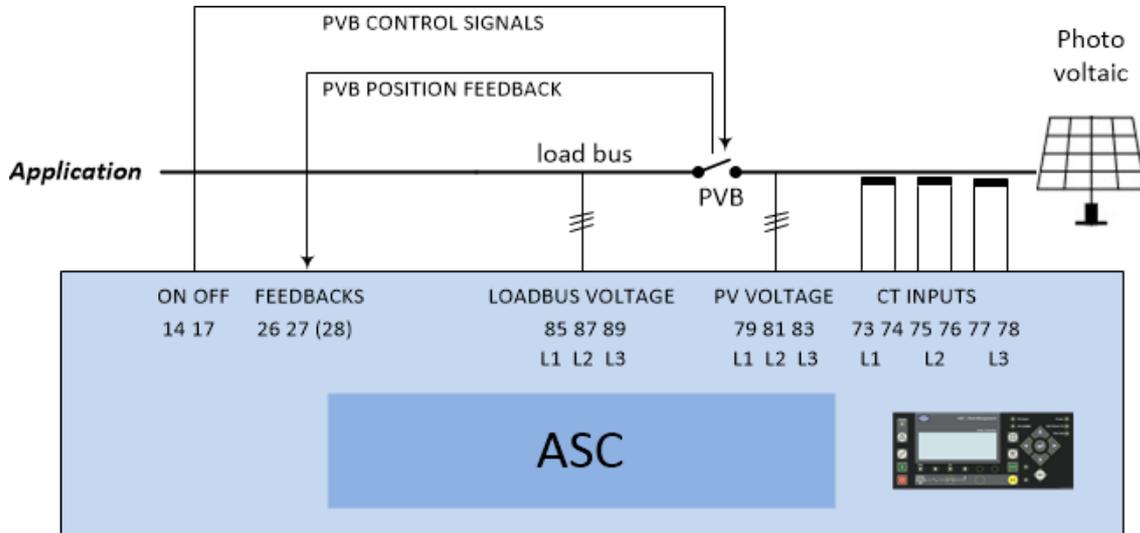
In stand-alone applications, the AC connections are wired to the ASC as shown below.

This means that the load bus voltage is connected to the ASC instead of the mains bus voltage as it is normally done with the DEIF AGCs.

This also means that no synchronising or breaker closure of the mains breaker can take place with the ASC. It is noted that the PVB if installed can be controlled by the ASC.

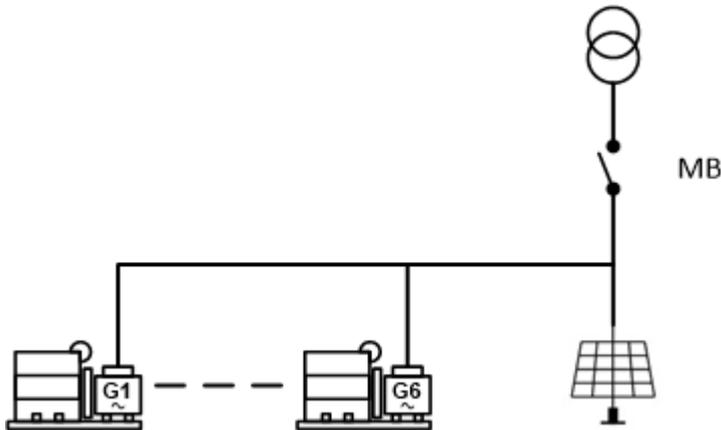


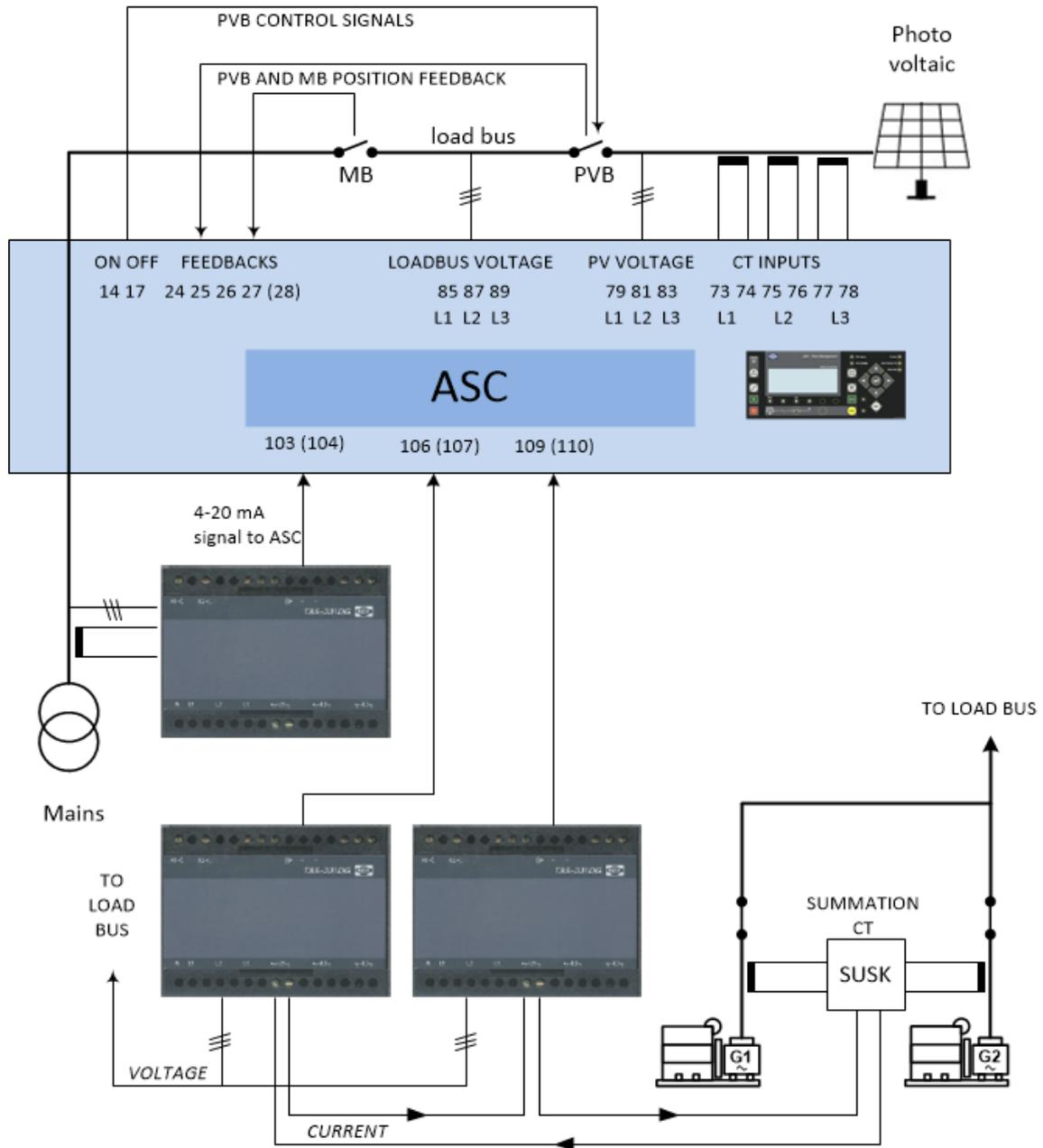
In power management solutions, the AC connections are wired to the ASC as shown below. Since there is no mains breaker, the load bus measurements are directly measuring on the load bus side.



DEIF ASC transducer connections

The schematic below shows the transducers that need to be installed for a stand-alone application where generators are connected to the load bus. This schematic shows a photovoltaic system with an MB and up to 2 gensets (PVB and GBs not shown for simplifying reasons).





GB-closed feedbacks are needed on two (2) available digital inputs.

Instead of the SUSK (or KSU) summation transformer, it is possible to use two sets of the transducers, one set per generator.