MASTER 2.0
Application Note

"MASTER 2.0 for Tie breaker synchronization"

NOTE

Read this entire manual and all other publications pertaining to the work to be performed before installing, operating, or servicing this equipment. Apply all plant and safety instructions and precautions. Failure to follow instructions can cause personal injury and/or property damage. Motors, turbines and any other type of generator must be equipped with protections (over speed, high temperature, low pressure…) depending on the power plant.

Any changes of the normal use of the equipment can cause human and material damage.

For further information, please contact your CRE Technology distributor or the After-Sales Service Team.
All CRE Technology products are delivered with one year warranty, and if necessary we will be happy to come on site for product commissioning or troubleshooting. The company also provide specific trainings on our products and software.

Technical documentation history

Date	Version	Comments
MAR 2017	C	Creation / JFB

You can download the latest version of this documentation, and other product-related documentation on our Web site: http://www.cretechnology.com/

Documentations available on CRE technology Web site:

- A53 Z0 9 0020 x-EN is the GENSYS2.0 technical documentation. This documentation is generally used for product integration.
- A54 Z0 9 0020 x-EN is the MASTER 2.0 technical documentation.
- A53 Z0 9 0031 x-EN is the translation help tool to download a CUSTOM language file.
- A53 Z0 9 0030 x- is the Complete variable list with labels, units and limits in all languages, in EXCEL format. This documentation is generally used as reference during the installation phase

Table of content

1 Overview

To match some application topologies, it is often necessary to synchronize both part of a bus bar.

The following figure shows a synoptic example of this application.

A PLC is necessary in this applications.
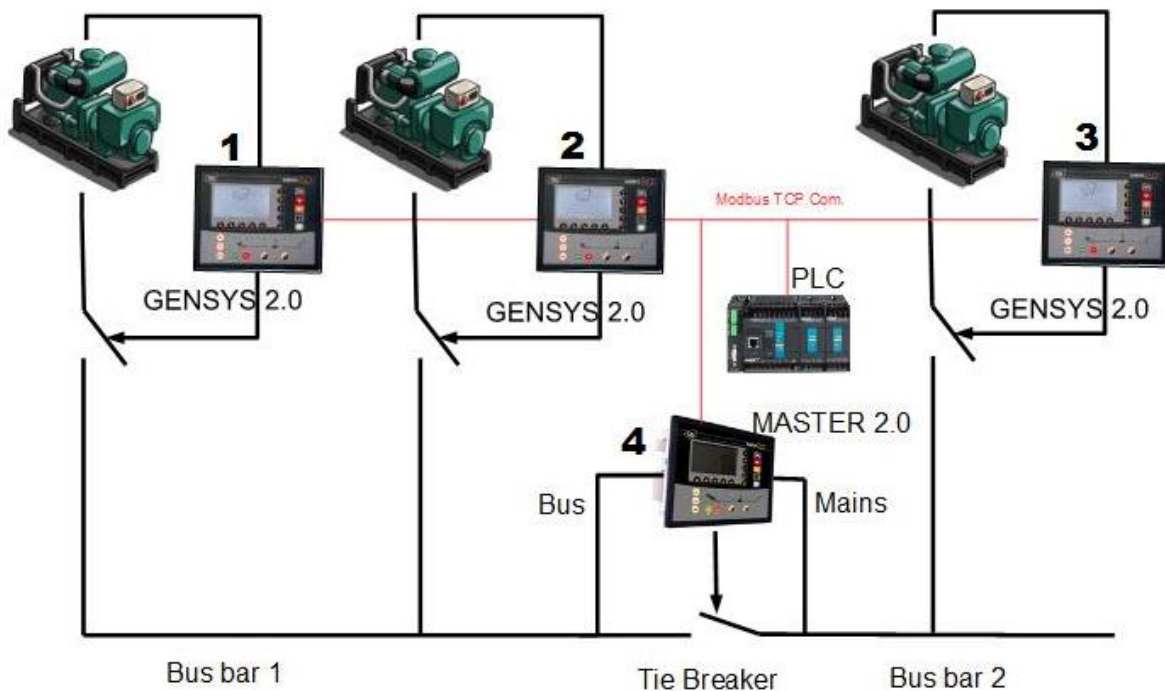

Figure 1 – Power plant synoptic example

NOTE :

 Bus bar 1 = BB 1= bus bar on left side, plugged in Gen side of MASTER 2.0 unit (B1,B2,B3).

Bus bar 2 = BB 2 = bus bar on right side, plugged in Mains side of MASTER 2.0 unit (B4,B5,B6).

2 Configuration

2.1 Overview and Can bus inhibition

When Tie breaker is open, DG1 and DG2 must communicate together (for load sharing) and ignore the DG3 (and vice versa). The MASTER 2.0 is permanently inhibited by GENSYS2.0 placed on his right, but not by left side GENSYS2.0, which are possibly synchronized.

When Tie breaker is closed (after synchronization of the 2 bus by the MASTER 2.0) the three GENSYS2.0 2.0 must communicate together, and inhibit the MASTER 2.0.

In this application it is necessary for GENSYS2.0 and MASTER 2.0 to inhibit each other according to the different sequences. Depending inhibition variable state (E2691, E2692…), communication between modules will be cut. For more details on inhibition variables refer to the GENSYS2.0 documentation.

Can inhibition principle:

- For the MASTER 2.0:
    - It does never take into account the GENSYS2.0 placed his right (BB 2 considered as Mains).
    - It takes into account the left GENSYS2.0 (BB1) only if the Tie breaker is open (to sync).

- For the GENSYS2.0 placed to the left of the MASTER 2.0 (BB1 / Central):
    - They take into account the MASTER 2.0 only if the MASTER 2.0 circuit breaker (Tie breaker) is open.
    - They take into account the GENSYS2.0 placed to the right of the MASTER 2.0 (BB2) only if the MASTER 2.0 circuit breaker (Tie breaker) is closed. All groups are in load sharing.

- For the GENSYS2.0 placed to the right of the MASTER 2.0 (BB2/Mains):
    - They do never take into account the MASTER 2.0.
    - They take into account the left placed GENSYS2.0 (BB1) only if the MASTER 2.0 circuit breaker (Tie breaker) is closed. All groups are in load sharing.

Note: The tie breaker position can be used by equations (GENSYS2.0 and MASTER 2.0) to set inhibition variables to 1 or 0 depending on the situation. The PLC can also change these inhibitions variables by Modbus or TCP communication.

	3 Generators together				2+1 generators			
	Tie breaker closed				Tie breaker open			
	E2691	E2692	E2693	E2694	E2691	E2692	E2693	E2694
GENSYS 1	0	0	0	1	0	0	1	x
GENSYS 2	0	0	0	1	0	0	1	x
GENSYS 3	0	0	0	1	1	1	0	1
MASTER 4	1	1	1	0	x	x	1	0

X = 0 when synchro

Table 2 – example of Inhibition table

2.2 MASTER 2.0 settings.

The table below lists the parameters to configure the MASTER 2.0 for this feature.

Parameter	Settings	Comment
Nbr of Brk. [E4084]	1	The MASTER 2.0 is configured to only drive the mains breaker. See: *A54 Z0 2 0001 A-en - MASTER 2.0 without power plant breaker.docx*
Paralleling mode. [E1148]	1	PERMANENT Mode.
Start on fault [E1841]	1	Authorize to start after Mains electrical fault (0=start/1= not start)
MANU 100% [E1621]	0	MANUAL Mode 100%

Table 1-Parameters

2.3 Control command sequence

In this application generators start and stop requests are not managed by the MASTER 2.0 and must be then controlled by an external PLC.

They can be written directly in Modus or TCP by changing variables or in wired using GENSYS2.0 or MASTER 2.0 digital inputs.

- Principle:

The GENSYS2.0 are placed in Auto Mode and started by physical input (J3) or virtual (Variable E2514), control by PLC.

The MASTER 2.0 is placed in Manu Mode regardless the state of the Tie breaker. He must be placed in Auto Mode only when the synchronization is requested, and set in Manu as soon as he closed the Tie breaker. Don't send a request to start to the MASTER 2.0

The tie breaker circuit can be re-opened at any time, by the controller or manually.
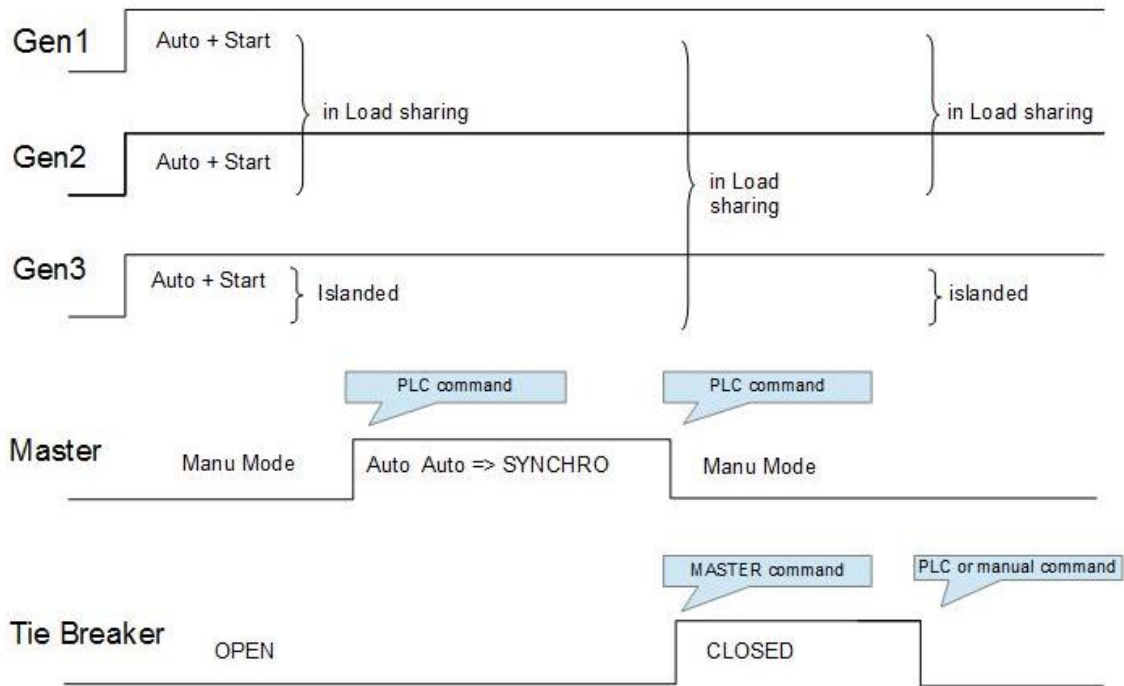
- Control sequence :

Figure 2 – Control sequence

Note: The variable E2946 allows you to change modes of operation (E2946 = 1 for Auto mode; E2946 = 3 for Manu mode). There are also functions of forcing entry logical or variable (E2260 = forcing Mode Auto; E2261 forcing Manu Mode).

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3 Important recommendations

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⚠️	**All protections (Mains and Gen) must be inactivated** ("not used") in MASER2.0 device.
⚠️	**MASTER 2.0 is only used to synchronize** the 2 bus bar. He does not control the power, ramp, load sharing… (Load sharing will be control by the GENSYS2.0 once coupled).
⚠️	A complex plant will not contain more than **32 products maximum** (GENSYS2.0 + MASTER 2.0)
⚠️	In the case of several Tie breaker installation, **only one synchronization request can be made simultaneously**. Only one MASTER 2.0 in AUTO mode.
⚠️	Le MASTER 2.0 should **never have a start request** (J3 or Virtual Start entry)

4 Complex example

- Synoptique
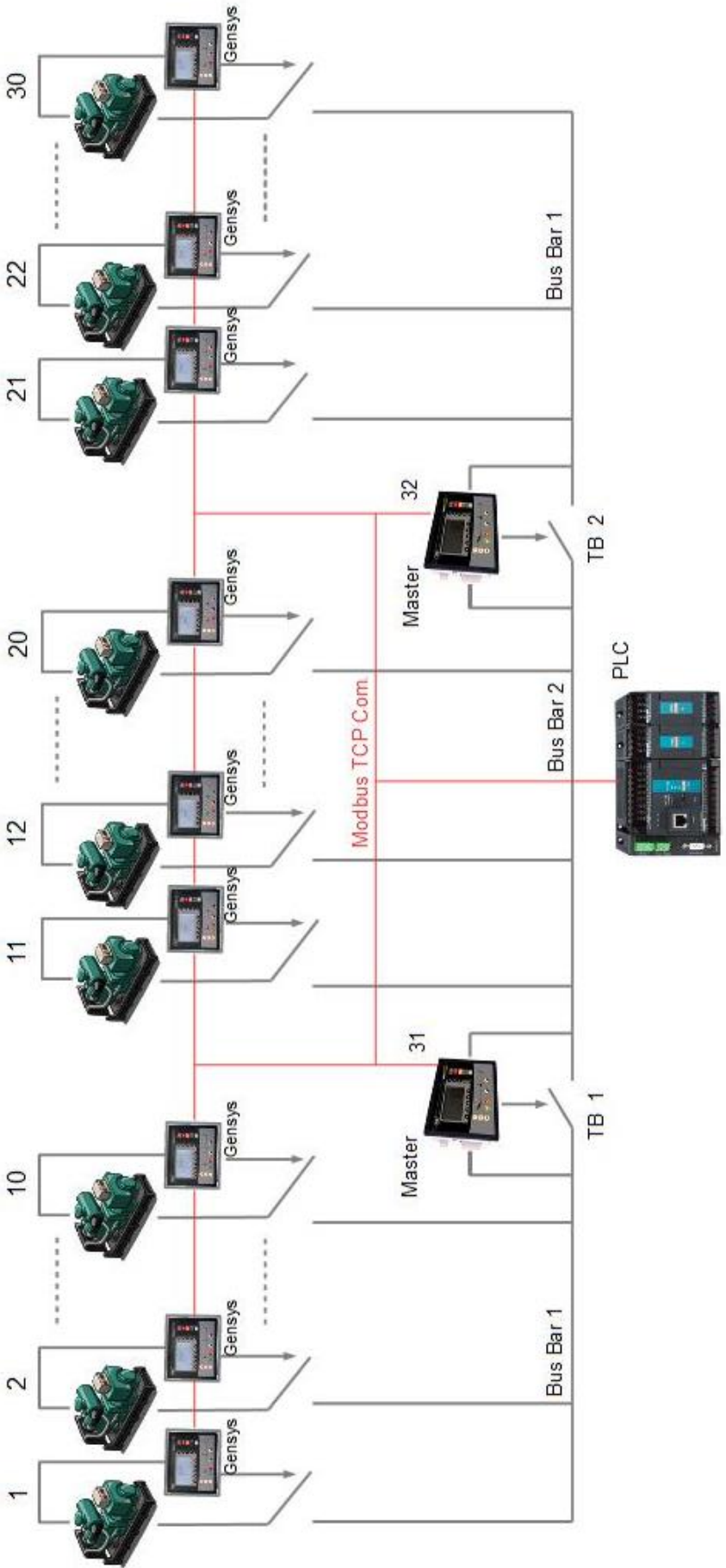
- <u>Inhibitions table</u>

CASE 1 : TP1 Open (Ouvert) - TP2 Open (Ouvert)

Inhib Variable:	BUS BAR 1			BUS BAR 2				BUS BAR 3					Master NB	
(col nb)	1	2	3 ...	10	11	12	13 ...	20	21	22	23 ...	30	31	32
(GENSYS NB)	2691	2692	2693 ...	2700	2701	2702	2703 ...	2888	2889	2890	2891 ...	2898	2899	2900
in GE1 ... GE10	0	0	0	0	1	1	1	1	1	1	1	1	x	x
in GE11 ... GE20	1	1	1	1	0	0	0	0	1	1	1	1	x	1
in GE20 ... GE30	1	1	1	1	1	1	1	1	0	0	0	0	1	1
in Master1	x	x	x	x	1	1	1	1	1	1	1	1	0	1
in Master2	x	x	x	x	x	x	x	x	1	1	1	1	1	0

CASE 2 : TP1 Open (Ouvert) - TP2 Closed (Fermé)

Inhib Variable:	BUS BAR 1			BUS BAR 2				BUS BAR 3					Master NB	
(col nb)	1	2	3 ...	10	11	12	13 ...	20	21	22	23 ...	30	31	32
(GENSYS NB)	2691	2692	2693 ...	2700	2701	2702	2703 ...	2888	2889	2890	2891 ...	2898	2899	2900
in Ge1 ... GE10	0	0	0	0	1	1	1	1	1	1	1	1	x	x
in GE11 ... GE20	1	1	1	1	0	0	0	0	0	0	0	0	x	1
in GE20 ... GE30	1	1	1	1	0	0	0	0	0	0	0	0	1	1
in Master1	x	x	x	x	1	1	1	1	1	1	1	1	0	1
in Master2	x	x	x	x	x	x	x	x	1	1	1	1	1	0

CASE 3 : TP1 Closed (Fermé) - TP2 Open (Ouvert)

Inhib Variable:	BUS BAR 1			BUS BAR 2				BUS BAR 3					Master NB	
(col nb)	1	2	3 ...	10	11	12	13 ...	20	21	22	23 ...	30	31	32
(GENSYS NB)	2691	2692	2693 ...	2700	2701	2702	2703 ...	2888	2889	2890	2891 ...	2898	2899	2900
in Ge1 ... GE10	0	0	0	0	0	0	0	0	1	1	1	1	x	x
in GE11 ... GE20	0	0	0	0	0	0	0	0	1	1	1	1	x	1
in GE20 ... GE30	1	1	1	1	1	1	1	1	0	0	0	0	1	1
in Master1	x	x	x	x	1	1	1	1	1	1	1	1	0	1
in Master2	x	x	x	x	x	x	x	x	1	1	1	1	1	0

CASE 4 : TP1 Closed (Fermé) - TP2 Closed (Fermé)

Inhib Variable:	BUS BAR 1			BUS BAR 2				BUS BAR 3					Master NB	
(col nb)	1	2	3 ...	10	11	12	13 ...	20	21	22	23 ...	30	31	32
(GENSYS NB)	2691	2692	2693 ...	2700	2701	2702	2703 ...	2888	2889	2890	2891 ...	2898	2899	2900
in Ge1 ... GE10	0	0	0	0	0	0	0	0	0	0	0	0	x	x
in GE11 ... GE20	0	0	0	0	0	0	0	0	0	0	0	0	x	1
in GE20 ... GE30	0	0	0	0	0	0	0	0	0	0	0	0	1	1
in Master1	x	x	x	x	1	1	1	1	1	1	1	1	0	1
in Master2	x	x	x	x	x	x	x	x	1	1	1	1	1	0

X : 0 synchro - 1 no synchro

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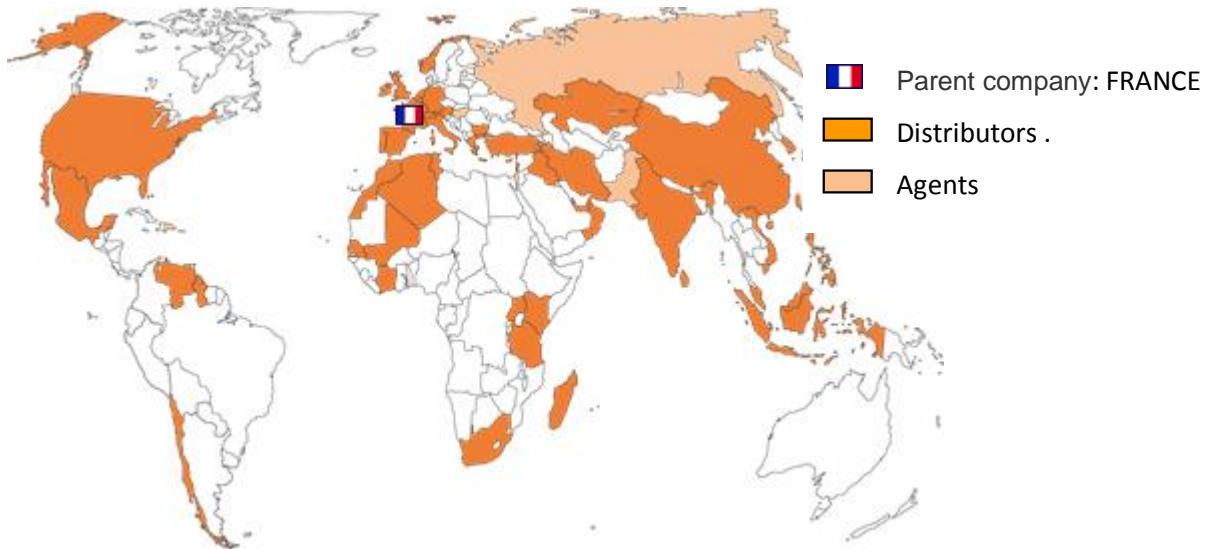Parent company: FRANCE

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Agents

Figure 2 – CRE Technology distributors

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