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GVI

Mobile Inverter

Application Note GVI IOAN Integration



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Non-warranty clause

We checked the contents of this publication for compliance with the associated hardware and software. We can, however, not exclude discrepancies and do therefore not accept any liability for the exact compliance. The information in this publication is regularly checked, necessary corrections will be part of the subsequent publications.

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Production site:

Germany

Parker Hannifin Manufacturing Germany GmbH & Co. KG
Electromechanical & Drives Division Europe [EMDE]
Robert-Bosch-Strasse 22
77656 Offenburg (Germany)
Tel.: + 49 (0781) 509-0
Fax: + 49 (0781) 509-98176
Internet: www.parker.com/eme <http://www.parker.com/eme>
E-mail: EM-Motion@parker.com <mailto:EM-Motion@parker.com>

Certified according to ISO 9001:2015

Parker Hannifin Manufacturing Germany GmbH & Co KG - Sitz: Bielefeld - Amtsgericht: Bielefeld HRA 15699
Partner liable to unlimited extent: Parker Hannifin GmbH, Sitz Bielefeld, Amtsgericht Bielefeld HRB 35489
Geschäftsführung der PARKER Hannifin GmbH: Dr.-Ing. Hans-Jürgen Haas, Kees Veraart, Chairman of the board: Dr.-Ing. Gerd Scheffel

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1 Introduction

1.1 About this document

1.1.1 Definitions

In this documentation the product Global Vehicle Inverter is referred to as “The motor controller” or GVI.

GVI is a family of motor controllers for use in systems with 24-650 DC (nominal) supply and power levels from 4,4 to 398 kVA. GVI frame sizes C, D, E are referred to as Low Voltage (LV) devices, frame sizes G and H are considered as High Voltage (HV) Devices. The GVI is suitable for most electric vehicle applications.

1.1.2 Terms and abbreviations

GVI	AC mobile inverter
LV	Low Voltage (24 – 96V)
HV	High Voltage (350 – 650V)
Application	A customer specific use of Parker hardware and software
CAN	Controller Area Network
Drive	Motor controller
NMT	Network management
OEM	Original equipment manufacturer
VMC	Vehicle master controller

1.1.3 This revision

This revision replaces all previous revisions of this document. Parker has made every effort to ensure that this document is complete and accurate at the time of printing. In accordance with our policy of continuous product improvement, all data in this document is subject to change or correction without prior notice.

1.1.4 Scope

The motor controller is a software configurable device. In a CAN (Controller Area Network) based system, the motor controller setup and operation can be managed by a vehicle master controller communicating over the CAN Bus.

The configuration of the drive can only be done with the CANopen protocol, which is implemented in the Parker GVI configuration tool.

Realtime command and feedback signals can be realized with the CANopen protocol (with 11 bit identifier) or the J1939 (with 29 bit identifier) and is called the *communication interface*, which is described in the document *192-300306Nx - GVI CAN Message Database* (excel format).

This document presents the general description for implementing a CANopen or J1939 communication interface between an IQAN master and a GVI inverter by means of an *External*

Function, which basically is a translation of the *192-300306Nx - GVI CAN Message Database* into IQAN format.

Before continuing with the configuration, ensure the Start-up and Commissioning section from the hardware manual (see chapter 1.1.5) has been completed and is fully understood. It is also helpful to have the Object Dictionary, the list of all parameters and variables the motor controller has available via the CAN bus, when reading through this manual.

1.1.5 Related documents

For more information about the inverter, see the following related documents.

Reference number	Document	Description
1	GVI Object Dictionary	The document is available from Parker as an HTML file
2	Product Manual for GVI-C D E	Parker EMDE Reference 192-300300Nx
3	Product Manual for GVI-G-H	Parker EMDE Reference 192-300302Nx
4	GVI CAN Message Database	Parker EMDE Reference 192-300301Nx

Table 1 References

2 IQAN External Functions general

An IQAN *External Function* project is a special project file that you can reuse in other normal project files. The idea is to make it possible to break out common application logic that you have in several other projects to a separate file.

External function projects files use the extension .idex.

When an external function is added to the application logic in a project file, it will be visible to the user. External functions look and behave as normal function groups, except they cannot be edited in the project file.

To use External functions, you must first tell IQAN-Design which external function project file you want to use. This is done under the 'External function' node in the project manager. Add an external file by clicking the *Add* button and select the file in the open file dialog box that pops up.

Adding an external file to a project file makes all top level function groups in that file available for use in the application logic.

To use a function group from an external file in your project file, go to the function group where you want to insert it, click the *Add* button, select the tab for external files and double-click or drag the wanted function group to the workspace. A function group is added. It will have the same name as in the external file as default, but you can change it to something else. The name of the external file will be added within angle brackets, <>, after the name to indicate that this is a function group that actually resides in a different project file.

The adjust items from the external function are automatically added to the adjust item container and can be added to adjust groups from there (or by dragging the corresponding channel from the external function instance).

Now you can interface the external function with your main application:

- Adjust your command configuration signals to the adjust channels
- Connect your realtime command signals to the FGI-channels
- Connect the feedback signals (FGO channels) with your own FGI_channels in your application
- Add a CANopen or J1939 module in your System Layout and drag and drop the respective GFIN/GFOUT or JFIN/JFOUT channels from the External Function to the module.
- Detailed information about the IQAN integration is added in a Comment Box in the respective External project file and in the Channel Description properties.

2.1 CANopen and J1939 External Functions

The predefined communication signals in the GVI device differ, dependent if a CANopen or J1939 is used.

Further on, there are some differences between LV (low voltage) and HV (high voltage) devices.

To be able to use the correct communication interface, Parker has defined 4 separate External Function projects:

GVI_CANopen_LV_xx_yy.idx	valid for low voltage GVI with CANopen communication interface
GVI_CANopen_HV_xx_yy.idx	valid for high voltage GVI with CANopen communication interface
GVI_J1939_LV_xx_yy.idx	valid for low voltage GVI with J1939 communication interface
GVI_J1939_HV_xx_yy.idx	valid for high voltage GVI with J1939 communication interface

The channels in the IQAN External functions end with _C or _J.

This is only to make a difference between CANopen (_C) or J1939 (_J)

This end of the channel names will not be used later on in this document.

2.2 Integrated Function Group functionality with the CANopen External Function communication interface:

NMT	Start/stop/Reset Node (the GVI will only work in operational mode)
EMCY	CANopen Emergency Error Messages with Error_code and Event_ID
SDO_in	Read the amount of active events and show 20 active errors maximum
PDO_cmd	send PDO command messages to the GVI (transmit rate must be set at 10 msec). Values can be limited and/or scaled, based on values from adjust items.
PDO_fdbk	read the PDO feedback signals from the GVI. Values can be retracted from common signals and/or scaled

CAN settings with CANopen

Default SA GVI	6 (optionally, dependant on physical GVI inputs: 7, 8 or 9)
Default Speed	250 kbps
RxPDO messages	Send Continuously at 10 msec

2.3 Integrated Function Group functionality with the J1939 External Function communication interface:

PGN_cmd	send the PGN command messages to the GVI (transmit rate must be set at 10 msec). Values can be limited and/or scaled, based on values from adjust items.
PGN_fdbk	read the PGN feedback signals from the GVI. Values can be retracted from common signals and/or scaled

CAN settings with J1939

Default SA IQAN Master	199
Default SA GVI	200 (optionally, dependant on physical input: 201, 202 or 203)
Default Speed	250 kbps
PGN command messages	Send Continuously at 10 msec

2.4 Input channels External Function: command side to GVI

FGI / Adjust item	External Function	Use to calculate the CAN communication messages
<i>GVI_type</i>	All	Affects Limits max possible Volt and Current setpoints
<i>GVM_max_speed</i>	All	Affects <i>CommandSpeed</i> , <i>CommandAccelerationChange</i> and <i>CommandDecelerationChange</i>
<i>GVM_max_current</i>	All	Affects <i>CommandAcCurrent</i>
<i>GVM_max_torque</i>	All	Affects <i>CommandTorque</i> , <i>AccTorqueLimit</i> and <i>BrakeTorqueLimit</i>
<i>GVM_max_power</i>	All	Affects <i>PosDcCurrentLimit</i> and <i>NegDcCurrentLimit</i>
<i>BatNomVoltage</i>	All	Affects <i>PosDcCurrentLimit</i> and <i>NegDcCurrentLimit</i>
<i>BiRotational</i>	All	Allows for pos and neg setpoints for <i>CommandSpeed</i> , <i>CommandTorque</i> and <i>CommandAcCurrent</i>
<i>SpdNeutralBrakeRampParSet</i>	All	Direct use in <i>CommandAll</i> (see OD for details)
<i>RegulatorSet</i>	All	Direct use in <i>CommandAll</i> (see OD for details)
<i>SpeedRampParameterSet</i>	All	Direct use in <i>CommandAll</i> (see OD for details)
<i>IgnoreLowDcBus</i>	All	Direct use in <i>CommandAll</i> (see OD for details)
<i>SpeedChangeFactor</i>	All	Affects <i>CommandAccelereationChange</i> and <i>CommandDecelerationChange</i>
<i>RequestedControlMode</i>	All	Direct use in <i>RequestedControlMode</i> and indirect use to block the setpoint for the non selected conrolmodes.
<i>SwitchOn</i>	All	Indirect use in <i>CommandAll</i> (see OD for details)
<i>Enable</i>	All	Indirect use in <i>CommandAll</i> and to enable the Command Setpoints.
<i>Rotate_backward</i>	All	Digital flag to send negative setpoints
<i>ActiveCurrentBoost</i>	All	Direct use in <i>CommandAll</i> (see OD for details)
<i>Speed_setpoint</i>	All	Setpoint in rpm, only positive values allowed Negative values in combination with <i>Rotate_backward</i>
<i>Torque_setpoint</i>	All	Setpoint in Nm, only positive values allowed Negative values in combination with <i>Rotate_backward</i>
<i>Voltage_setpoint</i>	All	
<i>AcCurrent_setpoint</i>	All	Setpoint in Amps, only positive values allowed Negative values in combination with <i>Rotate_backward</i>

<i>T_upramp</i>	All	Affects <i>CommandAccelerationChange</i>
<i>T_downramp</i>	All	Affects <i>CommandAccelerationChange</i>
<i>AccTorqueLimit</i>	All	Affects <i>AccTorqueLimit</i>
<i>BrakeTorqueLimit</i>	All	Affects <i>BrakeTorqueLimit</i>
<i>PosDcCurrentLimit</i>	All	Direct us in <i>PosDcCurrentLimit</i> with limitation of the <i>GVM_max_power</i> and <i>BatNomVoltage</i>
<i>NegDcCurrentLimit</i>	All	Direct us in <i>NegDcCurrentLimit</i> with limitation of the <i>GVM_max_power</i> and <i>BatNomVoltage</i>
<i>OpenDrainOutput_1</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>OpenDrainOutput_2</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>OpenDrainOutput_3</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>OpenDrainOutput_4</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>OpenDrainOutput_5</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>OpenDrainOutput_6</i>	LV only	Direct use in <i>CommandAll</i> (see OD for details)
<i>Node_ID_GVI</i>	CANopen only	Sets the node ID of the GVI
<i>Goto Pre-operational</i>	CANopen only	Puls signal to force the node into pre-operation mode
<i>Goto Operational</i>	CANopen only	Puls signal to force the node into operation mode The GVI will only send feedback signals in this mode.
<i>Reset node</i>	CANopen only	Puls signal to reset the node
<i>Read_active_events</i>	CANopen only	Puls signal to read all active events

2.5 Output signals External Function: feedback side from GVI

Function Group Output	External Function	Description
<i>Enabled</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>Tripped</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>CurrentAbilityReduced</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>CurrentBoostActive</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>ErrorActive</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>WarningActive</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>Regeneration</i>	All	Retracted from <i>StatusAll</i> (See OD for details)
<i>DIN_01</i>	All	Retracted from <i>DigitalInStatus</i> (See OD for details)

<i>DIN_02</i>	All	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_03</i>	All	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_04</i>	All	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>Actual_control_mode</i>	All	See OD for details
<i>Actual_llm_type</i>	All	See OD for details
<i>Regulator_status</i>	All	See OD for details
<i>CanSignalRotorSpeed</i>	All	See OD for details
<i>CanSignalRmsMotorCurrent</i>	All	See OD for details
<i>CanSignalFilteredVoltage</i>	All	See OD for details
<i>CanSignalActTorque</i>	All	See OD for details
<i>DcBusCurrent</i>	All	See OD for details
<i>AbillityAccelerationCurrent</i>	All	See OD for details
<i>SensorAngle</i>	All	See OD for details
<i>Iq</i>	All	See OD for details
<i>Id</i>	All	See OD for details
<i>CanSignalMotorTemp</i>	All	See OD for details
<i>CansSignalInverterTemp</i>	All	See OD for details
<i>Event_1</i>	All	See OD for details
<i>Event_2</i>	All	See OD for details
<i>Event_3</i>	All	See OD for details
<i>Event_4</i>	All	See OD for details
<i>ODO_1_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>ODO_2_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>ODO_3_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>ODO_4_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>ODO_5_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>ODO_6_On</i>	LV only	Retracted from <i>StatusAll</i> (See OD for details)
<i>DIN_05</i>	LV only	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_06</i>	LV only	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_07</i>	LV only	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_08</i>	LV only	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>DIN_09</i>	LV only	Retracted from <i>DigitalInStatus</i> (See OD for details)
<i>Event_5</i>	CANopen only	See OD for details
<i>Event_6</i>	CANopen only	See OD for details
<i>Event_7</i>	CANopen only	See OD for details

<i>Event_8</i>	CANopen only	See OD for details
<i>Event_9</i>	CANopen only	See OD for details
<i>Event_10</i>	CANopen only	See OD for details
<i>Event_11</i>	CANopen only	See OD for details
<i>Event_12</i>	CANopen only	See OD for details
<i>Event_13</i>	CANopen only	See OD for details
<i>Event_14</i>	CANopen only	See OD for details
<i>Event_15</i>	CANopen only	See OD for details
<i>Event_16</i>	CANopen only	See OD for details
<i>Event_17</i>	CANopen only	See OD for details
<i>Event_18</i>	CANopen only	See OD for details
<i>Event_19</i>	CANopen only	See OD for details
<i>Event_20</i>	CANopen only	See OD for details