GWY-300
(CAN Gateway)

USER'S MANUAL

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If service is required then pack the unit in its original packaging container or, if unavailable, any suitable rigid container. If a substitute container is used, surround the unit with shock absorbing material; damage in shipment is not covered by the warranty. Include a letter with the unit describing the difficulty and Hardware Revision and Software Version. Send to the following address:

Renu Electronics Pvt. Ltd.
Survey No. 2/6,
Baner Road,
Pune-411045

All returns will be tested to verify customer claims of noncompliance with the product warranty. Improper return packaging, which makes verification impossible, will void the warranty. If noncompliance is verified and is not due to customer abuse or the other exceptions described with product warranty, Renu Electronics will, at its option, repair or replace the Product returned to it, freight prepaid, which fail to comply with the foregoing warranty, provided REPL is notified of such noncompliance within the one-year warranty period.

ASSISTANCE

This manual is designed to provide the necessary information for trouble-free installation and operation of your new Gateway product. However, if you need assistance, please call Renu Electronics Pvt. Ltd. at 91-20-27292840 or visit our web site at www.renuelectronics.com

MANUAL REVISION

If you contact us in refference to this manual, please include the following document number

Name	:	CAN Gateway (GWY-300-B) User's Manual
Part Number	:	URML204
Document	:	UMAN\GWY-300-B\0106
Revision	:	Revision 2

Revision Number	Date	Description
Preliminary	29/11/2005	
Revision 0	19/01/2006	Seven Segment Display is replaced with LED and hence corrsponding changes are done.
Revision 1	08/02/2007	Chapter 6: Diagnostic section is added Appendix: PGN information updated. Troubleshooting section is also added.
Revision 2	12/12/2011	System Requirement for Gateway setup software revised.

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For New product: This product is warranted against defects in materials and workmanship for a period of 12 months from the date of shipment to Buyer.

For Rectified Products: Any product that will be replaced will have Warranty for 6 months or upto Original Product Warranty period whichever is greater.

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IMPORTANT

Gateway Products are intended to be Protocol Converters/Data Sharer devices that can also take control actions on request of device being connected. It is assumed that user is well acquainted with the PLC / Inverters / Controllers being used.

Any Mechanical or Electrical Modification to this Unit will void all Warranties.

Contents

INTRODUCTION

In this chapter. . . .

♦   Purpose of this manual

♦   Introduction To Gateway

♦   GWY-300-B Specifications

1.1 Purpose of this manual

Thank you for purchasing GWY-300-B Product from Renu Electronics Pvt. Ltd..

The intention of this User Manual is to provide a guide for Safe installation, Configuration and operation of GWY-300-B. **Functionality of all the Gateway models is same.**Read this User manual thoroughly before installing and operating GWY-300-B,
This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information in this document may not cover all the details or variations in hardware or software. Features described herein may not be present in all hardwares. Renu Electronics Pvt. Ltd. reserves the right to update information in this publication without prior notice.

1.2 Introduction to Gateway

Gateway is a Protocol Converter / Data sharer for devices like PLCs, inverters (Adjustable Speed Drives), and other Controllers. Gateway has two serial ports that connect with two different devices. These devices share data through Gateway. Gateway communicates with a device to get the information required by the device connected on the other port. The device that requires data is called Destination Device and the device that provides data is called Source Device. Information could be,
- value of a PLC register.
- status of a PLC coil.
- Command from Source Device to Destination Device to perform any action at the destination end.

Configuration Of Gateway
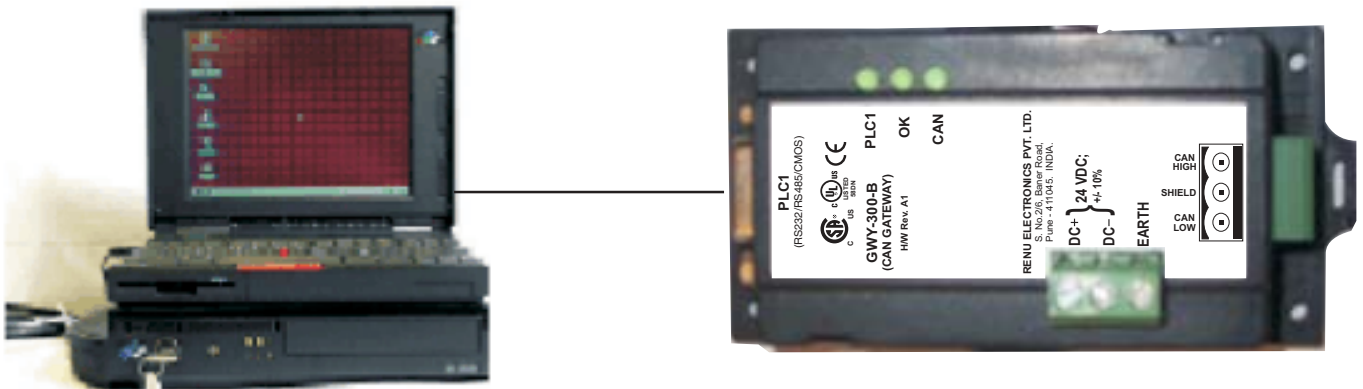
Note: Please refer 'IBM Download' in section 3.4.

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Normal Operation:

GWY-300 connects one field device (serial link) to another over CAN BUS. User can define the blocks of registers to be fetched from one device and to be transferred to the other. Our users have used Gateway units in different applications across many industries. The typical configuration includes the following:
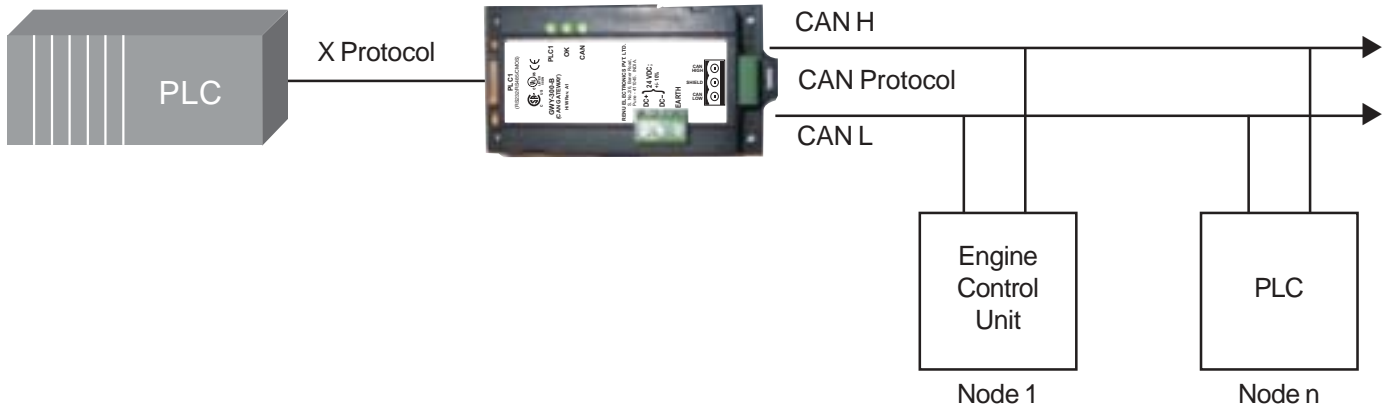
INTRODUCTION

1.3   GWY-300-B Specifications

Power	:	+24V DC + 10%, 100mA max
LED's	:	3 Bicolour LEDs for status indication.
Communication Ports	:	2 Communication port with
COM1	:	RS232 / RS422 / RS485 / CMOS
COM2	:	CAN-J1939/71 / CANopen Slave

(Isolation between communication ports and Power supply, through DC-DC coupler is 1 KV)

PLC1 / COM1	:	Connects to PC for setup download or connects to PLC1 at runtime.
PLC2 / COM2	:	Connects to CAN BUS(J1939/71 / CANopen Slave).

(Isolation between communication ports, through opto-isolation is 1KV rms for 1 min)

Operating Temperature	:	0° to 60°C
Storage Temperature	:	-20° to 80°C
Humidity	:	10% to 90% (Non condensing)
Mounting	:	DIN rail or back panel mounting
Dimensions (DIN rail)	:	105mm(L) X 40mm(D) X 51mm(W)
Weight	:	125 gm approx.
Certifications	:	CE / CSA with UL
Immunity to ESD	:	Level 3 as per IEC1000-4-2
Immunity to Transients	:	Level 3 as per IEC1000-4-4
Immunity to Radiated RF	:	Level 3 as per IEC1000-4-3
Immunity to Conducted RF	:	Level 3 as per IEC1000-4-6
Emissions	:	EN55011 CISPR A

HARDWARE

In this chapter. . . .

♦   Dimensional Details And Mounting Instructions

♦   Communication Port Details

♦   LED Status

2.1   Dimensional details And Mounting Instructions

GWY-300 -B unit can be mounted on a back panel or on a DIN rail or can be left hanging. It comes with a separate DIN rail plate when it is packed. User will have to attach the DIN rail plate to the unit if it has to be mounted on a panel or DIN rail. If it has to be left hanging, make sure to screw the cables to the DB9 connectors on the Gateway unit. DIN rail plate also has the provision to screw the unit to the back panel. Following drawing shows how to attach the DIN rail plate to the unit:
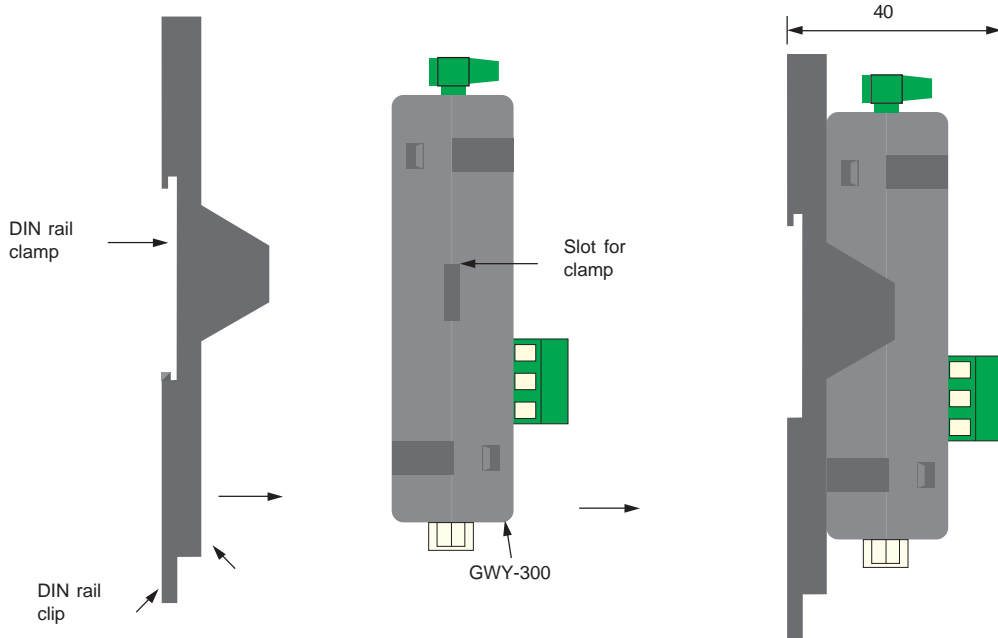
Follow instructions given below:

1. Attach the DIN rail plate to the unit using the clamps on the DIN rail plate.
2. Pull out the clip of the plate.
3. Put the unit on the DIN rail.
4. Push the clip in to secure the unit on the DIN rail.

GWY-300-B unit is shipped with a separate DIN rail plate which has to be attached to the unit, if needed. User can use the unit with or without the DIN rail plate. Following sketch shows mounting details of GWY-300-B with the DIN rail plate.

50.6 mm
(1.99 in)

109 mm
(4.29 in)

86.9 mm
(3.42 in)

39.3 mm
(1.55 in)
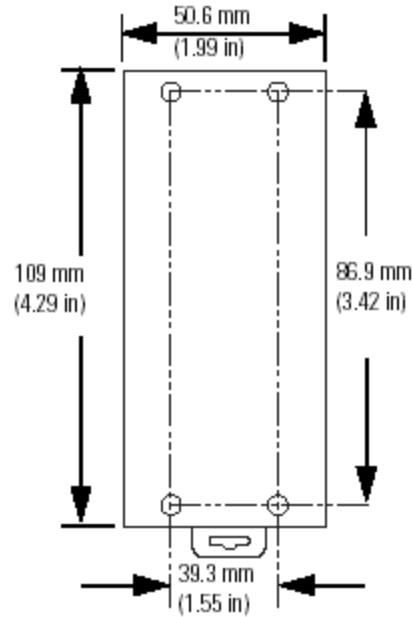
2.2   Communication Port Details

Gwy-300-B has two communication ports COM1 and COM2. COM1 port is compactible to RS232/ RS422/ RS485 and other is CAN communication port (COM2). Pinout of these ports are as shown below:

PLC1 / COM1

RX- (RS422/RS485)
TX- (RS422/RS485)
TXD (CMOS)
+5VDC*
(DO NOT USE)

9
8
7
6

5
4
3
2
1

Signal Ground
RX+ (RS422/RS485)
RXD (RS232C/CMOS)
TXD (RS232C)
TX+ (RS422/RS485)

DB9 Female
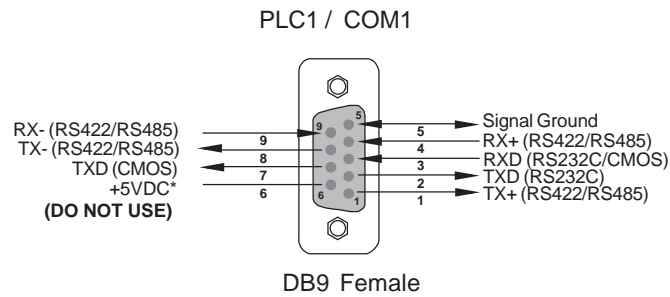
Do not use pin no. 6 of PLC1 / COM1.
**Refer our website (www.renuelectronics.com) for your specific Cable requirements

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Pin Description

Pin	Name	Signal Level	Description
1.	TX+	RS422 / RS485	Differential Transmit +, also referred as TXA
2.	TXD	RS232	Transmit
3.	RXD	RS232 / CMOS	Receive
4.	RX+	RS422 / RS485	Differential Receive +, also referred as RXA
5.	GND	-	Signal Ground common to all signals.
6.	+5VDC	-	**DO NOT USE**
7.	TXD	CMOS	Transmit
8.	TX-	RS422 / RS485	Differential Transmit -, also referred as TXB
9.	RX-	RS422 / RS485	Differential Receive -, also referred as RXB

User can convert RS485 4 wire + Signal Ground system to a 2 Wire + Signal Ground system by shorting following signals in the communication cable:

```
TX+ ────────────
TX- ─────╲  ╱──────── A
RX+ ─────╱  ╲──────── B
RX- ────────────
SG  ──────────────── SG
```
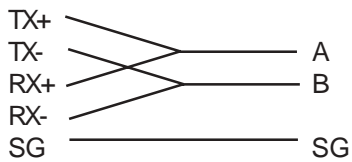
Note: **If user has attached shield to Earth on Device end, leave the shield open on Gateway end. If user has connected shield to Signal Ground on Device end, connect shield to Signal Ground on Gateway end.**

A and B are polarity insensitive. Twisted pair cable should be used for Rs485 Network.

***Upto 31 Devices can be multi-dropped on RS485* port of Gateway.**

Port Details for COM2

COM2

→ Pin 1

PIN	SIGNAL
01	CAN_H
02	Shield
03	CAN_L
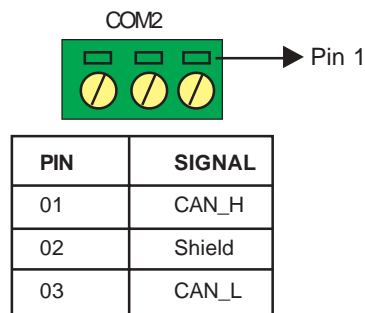
2.3 LED Status

There are 3 LEDs for status indication.

Bicolour LEDs status:

LED			
OK	Green	OFF	No Firmware
		Flashing	IBM Download
		ON	Both side (COM1 and COM2) communication OK
	Red	OFF	Configuration Ok
		ON	Configuration Fault
PLC1	Green	OFF	No data received on PLC1 Port
		Flashing	Receiving data on PLC1 Port
		ON	-
	Red	OFF	No error in PLC1 attach or while block execution
		Flashing	PLC1 attach error or error while block execution
		ON	-
CAN	Green	OFF	No data received on CAN Port
		Flashing	Receiving data on CAN Port
		ON	-
	Red	OFF	-
		Flashing	-
		ON	-

<u>GETTING STARTED</u>

In this chapter. . . .

♦   Introduction To CAN(J1939)

♦   Introduction To GWY-300-B

♦   GWY-300-B Operation

3.1 Introduction To CAN

The Controller Area Network (CAN) is a serial bus system, was defined in the late 1980 by Bosch, especially suited for networking 'intelligent' devices as well as sensors and actuators within a system or sub-system. CAN consists of 3 layers, Physical Layer, Data link Layer and Application Layer.

It has the following characteristics:

- Uses a single terminated twisted pair cable
- Is multi master
- Maximum Signal frequency used is 1 Mbit/sec
- Length is typically 40M at 1Mbit/sec up to 1KM at lower speed
- Has high reliability with extensive error checking

CAN is unusual in that the entities on the network, called nodes, are not given specific addresses. When data are transmitted by CAN, no stations are addressed, but instead the content of the message (e.g. rpm or engine temperature) is designated by an identifier that is unique throughout the network. Identifier not only defines the content but also determines the messages' priority.

CAN Serial Bus

CAN is a serial bus system with multi-master capabilities, that is, all CAN nodes are able to transmit data and several CAN nodes can request the bus simultaneously. The serial bus system with real-time capabilities is the subject of the ISO 11898 international standard and covers the lowest two layers of the ISO/OSI reference model. In CAN networks there is no addressing of subscribers or stations in the conventional sense, but instead, prioritized messages are transmitted. A transmitter sends a message to all CAN nodes (broadcasting). Each node decides on the basis of the identifier received whether it should process the message or not. The identifier also determines the priority that the message enjoys in competition for bus access.

Signal Characteristics

CAN may be implemented over a number of physical media so long as the drivers are open-collector and each node can hear itself and others while transmitting (this is necessary for its message priority and error handling mechanisms). The most common media is a twisted pair 5v differential signal which will allow operations in high noise environments.

When running Full CAN (ISO 11898-2) at its higher speeds it is necessary to terminate the bus at both ends with 120 Ohms. The resistors are used to prevent reflections.

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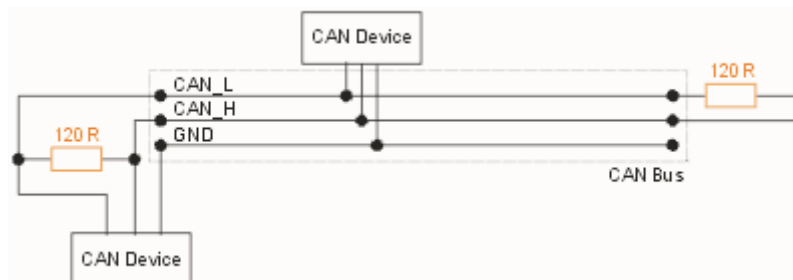
Message Format

The CAN protocol uses a modified version of the Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) technique used on Ethernet. Should two messages determine that they are both trying to send at the same time then instead of both backing off and re-trying later as is done with Ethernet, in the CAN scheme, the transmitters detect which message has the highest priority and only the lower priority message gets delayed. This means that a high priority message is sure of getting through.

CAN protocol supports two message frame formats, only essential difference is in the length of the identifiers (ID). In Standard format, length of ID is 11 bits and in Extended format the length is 29 bits. The message frame for transmitting frames comprises 7 main fields.

A. Standard format CAN Message(CAN 2.0A)

| Arbitration Field | | | Control Field | Data Field | | CRC Field | | ACK Field | End of Frame | Int | Bus Idle |

| SOF | 11 BIT IDENTIFIER | RTR | IDE | ro | DLC | 0-8 Bytes | 16 BIT CRC | | | | |

SOF	ARBITRATION	CONTROL	DATA	CRC	ACK	EOF	INT
1Bit Bit	12 or 32 Bit	6 Bit	0-8 Bytes	16 Bit	2 Bit	7 Bit	3
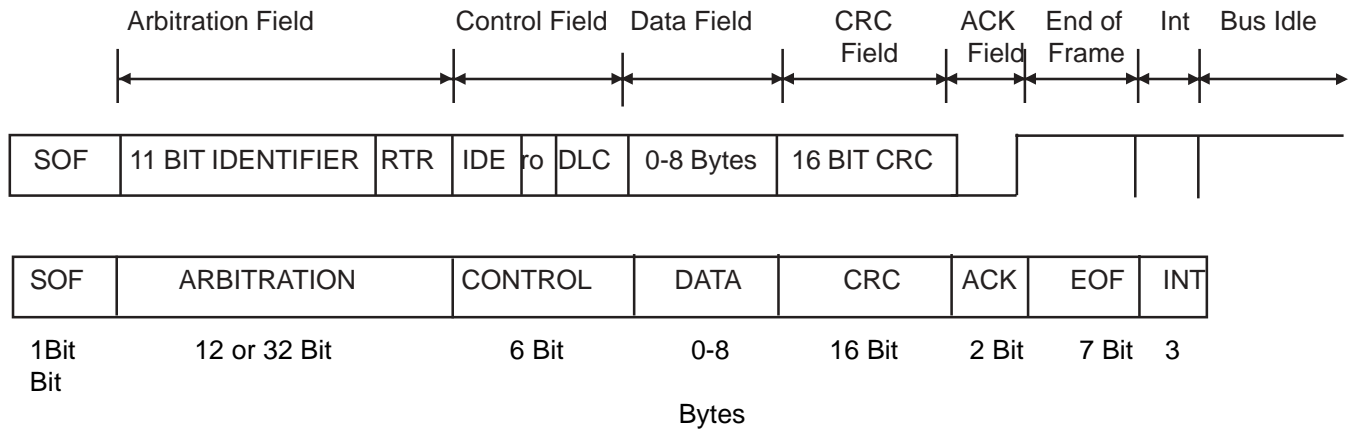
B Extended format CAN Message(CAN 2.0B)

SAE J1939 Overview

J1939 is the automotive CAN standard developed by the Truck & Bus Control and Communications Network Subcommittee of the Society of Automotive Engineers (SAE). SAE maintains family of standards which govern the design and use of devices that transmit electronic signals and control information among vehicle components. Planned for use in light, medium and heavy duty trucks it is also now being used in conventional passenger vehicles.

J1939 was designed for the CAN 2.0 (CAN Part B) specification. *It is the application layer that uses the larger 29 bit identifier.*It uses a peer to peer protocol where most messages are broadcasted versus directed to individual nodes. In J1939 each CAN Node is referred to as an Electronic Control Unit (ECU). Every ECU has node address.

SAEJ1939 has following features:

1. 29 bit Identifier
2. 250Kbps Baud rate
3. 8 Priority Classes
4. Predefined message types
5. Destination specific communication and Broadcasting

The applications and/or network layer provide a string of information that is asimulated into a protocol data unit(**PDU**). The protocol data unit provides a framework for oraganising the information that is key to each CAN data frame that is send. In J1939,Data type, Range, Repetation Rate etc together with the corresponding parameter group number determine the respective message identifier.
The SAE J1939 frame format is as shown.
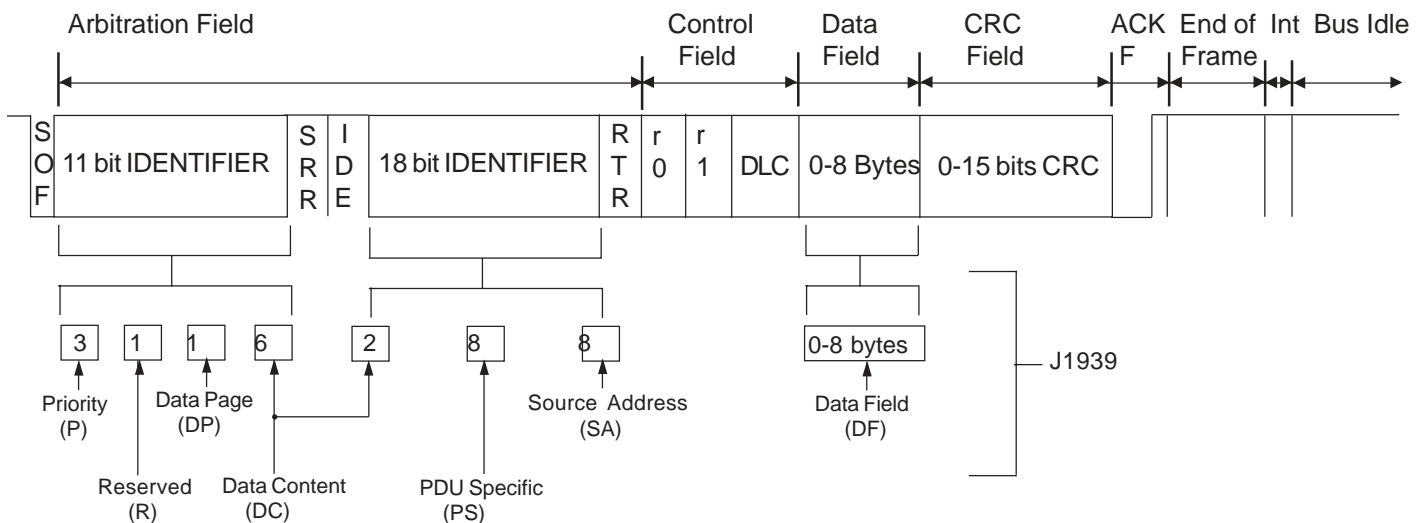
Two PDU formats are defined PDU1 format(PS=Destination address) and PDU2 format(PS=Group Extension)

1. PDU1 format allows for direction of CAN data frame to a specific destination address(device).

2. PDU2 format can only communicate CAN data frames that are not destination specific.

J1939 messages are sent using the CAN Extended Frame. A J1939 message consists of the following components:

Priority (P)– This 3-bit field is used to define the priority during arbitration. '000' is the highest priority and is usually associated with high-speed control messages. Low priority is used for noncritical configuration and information messages.

Data Page (DP)– This 1-bit field defines on which data page (0 or 1) the message is defined in the J1939 specification. Page 0 contains the messages that are presently defined, while Page 1 is for future expansion.

Protocol Data Unit (PDU) Format (PF) – This 8-bit field determines the format of the message and is one of the fields that determines the Parameter Group Number of the message (see the **"Parameter Group Number"** section). If the value is between 0 and 239, the message is a PDU 1 Format message. These messages are sent to specific addresses (CAs). If the value is between 240 and 255, the message is a PDU 2 Format message. These messages are not sent to a specific address (CA), but are instead broadcast to the entire network.

PDU Specific (PS) – This 8-bit field is either the Destination Address (PDU 1 Format) or the Group Extension (PDU 2 Format).

Source Address(SA) – This 8-bit field is the address of the CA that sent the message.

Data Length (DL)– The number of data bytes in the message.

Data – Up to 8 bytes of data.

Most messages are intended to be broadcast messages, or PDU 2 Format, where the message is not sent to a particular address. The J1939 specification defines PDU Format and PDU Specific values for many messages by specifying the message Parameter Group Numbers (see the **"Parameter Group Number"** section).

A J1939 node can send messages to other nodes, or it can request messages from other nodes, either globally or with a specific destination address. If a node receives a request sent to it specifically, it must process the message and send some sort of acknowledgement. If a node receives a global request, it must respond if it can. If a node receives a broadcast message, it must determine whether or not it is relevant.

 J1939 uses three methods to communicate over the CAN bus.

- Destination specific communications use the PDU1 (Protocol Data Unit 1) format to send and receive data. The PDU1 format allows a message to be directed to specific ECU (CAN Node). The destination address is included in the CAN PDU1 CAN frame.

- Broadcast Communications use the PDU2 (Process Data Unit 2) format to send a message to multiple nodes. The PDU2 message format identifies a message number versus a node number. In these applications receiving ECU's monitor the CAN bus for specific messages. For example a display unit may ignore all other messages as it monitors the bus waiting for the PDUs containing Fuel Temperature and Fuel Pressure.

- Proprietary Communications use both PDU1 and PDU2 formats to send data.

Parameter Group Number

The J1939 specification defines allowable messages by their Parameter Group Number (PGN). The Parameter Group Number is a 3-byte value that uniquely defines the message purpose. A PGN has the following format.

0	Reserved	Data page bit	PDU format	Group Extension
6 bits	1 bit	1 bit	8 bits	8 bits

Data transfered on the CAN bus is defined as Parameter Groups (PGs). PG's define where the data is located in the CAN Data frame, priority and transmission repetition rate. PG's are identified with Parameter Group Numbers (PGN's) . Parameters are grouped according to some similar characteristics into Parameter Groups and are expressed by its Parameter Group Number (PGN). This is the number used in J1939 to access the data about a particular parameter or a set of parameters.

3.2   Introduction To GWY-300-B

GWY-300 -B(CAN Gateway) allows serial device such as PLCs, Inverters and controllers to exchange data on CAN Bus. In the same way, it allows devices like ECU (Which support CAN J1939/71) to make their data available to devices like PLCs, so that some control actions can be taken. GWY-300 -B(CAN Gateway) supports SAEJ1939/71 Application Layer.

GWY-300-B has two serial ports, one is compatible to RS232/RS422/RS485/CMOS levels, which can be connected to device like PLCs, Inverters and controllers and the other is CAN port. The CAN connection is a two wire high speed network.These two ports are isolated from each other.

GWY-300-B communicates with the ECU(Electronic Control Unit) using SAE J1939/71 protocol. This allows gateway to access various engine parameters from CAN port. Gateway provides these parameters to third party serial devices like PLCs,Controllers. The PLC can then make decisions based on the parameter values. Following engine parameters are supported but not limited to.

<div align="center">

1 Engine Hours   2 Engine RPM
3 System Voltage   4 Oil pressure

</div>

Gateway setup software allows different engine parameters to be mapped to any register on the other side PLC/Device.

The complete configuration for a unit is termed as 'Project'. Project comprises of device names, Register addresses, condition for block execution etc.

Block may contain information like copy number of words from one device to other device and conditions for copy, if any. Gateway transfers data between two devices by execution of blocks.

After the Project is defined, Drivers for required devices and Project should be downloaded. Gateway can now communicate with the CAN devices and serial devices(e.g. PLC or SCADA).

3.3   GWY-300-B Operation-Configuration And Communication

Gateway can communicate with serial and CAN devices using appropriate cables and configuration. Microsoft Windows® based configuration software, Gateway Setup, configures the Gateway unit. 'Configuration' means making the Gateway unit work as per system requirements.

Complete configuration for a Gateway using the Gateway Setup is termed as a 'Project'. A Project consists of Devices to be attached on two ports, Communication settings for two ports to communicate with two devices, Register addresses for data transfer, Conditions for data transfer etc.

Gateway can now communicate with the specified devices without any change in the Gateway hardware. To communicate with a device, Gateway needs Communication Drivers for the devices and 'Gateway - Device' communication cables.

Each Device has a unique and predefined protocol for communication. Gateway driver has this protocol to communicate with the desired device. As two devices are connected on Gateway, it requires two drivers for communication.

3.4   Configuration of GWY-300-B (IBM Download)

User MUST download Project, PLC1 driver and PLC2 driver in Gateway before installing any system using Gateway. Gateway can accept drivers and configuration data on COM1 port. User needs a special IBM download cable for downloading configuration in Gateway. All configurations can be downloaded only form Serial port (Port 1). The other port is dedicated for CAN-J1939/71 (Port 2).

If any change in the current / working project is made, user must download the changed project in Gateway.

Pin details of IBM download cable for GWY-300-B are as follows:

DB9 Male (Gateway)	DB9 Female (IBM)
2	2
3	3
5	5
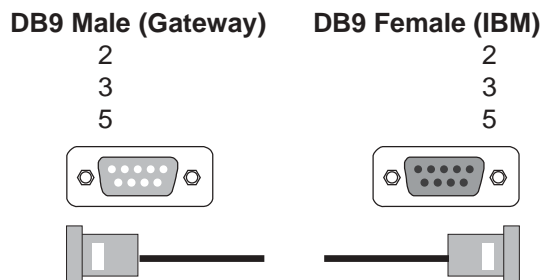
1.For downloading Firmware,drivers and project switch off the GWY-300-B unit.
2.Power ON the unit again.
For Master-Master mode:
OK LED is on at power on, it checks if the PLC1 is attached. If PLC1 is not attached then PLC1 Red LED glows and then it goes in IBM download mode for 10 sec. In IBM download mode OK LED flashes.

For Master-Slave Mode:
The unit will go into the IBM download mode for 10 sec at power ON.
For the first time download Firmware, driver and project.
Only in IBM download mode firmware, drivers and project can be downloaded.

At power on, if OK LED does not glow indicating that the downloaded firmware, drivers or project CRC are not correct or either of them is not present.
IMPORTANT NOTE:
AS GATEWAY HAS MULTIPLE SIGNALS ON ITS COMMUNICATION PORTS, IBM CABLE FOR GATEWAY MUST HAVE ONLY THREE RS232 SIGNALS (TXD, RXD AND GND) AS MENTIONED ABOVE.
9-9 PIN CORE CABLE SHOULD NOT BE USED.

3.4.1 When GWY-300-B can accept configuration?

If current driver present for PLC1 port is Master (e.g. Modbus (Gateway as Master))

First, it is checked that whether device is connected on port1
If device is connected, it continues normal operation
If device is not connected, it checks for IBM download mode for 10sec.
This sequence continues until either is satisfied.

If current driver present for PLC1 port is Slave (e.g. Modbus (Gateway as Slave))

If Port1 of Gateway is Slave, all the configurations should be downloaded only at power on for 10sec.

GWY-300-B FEATURES

In this chapter. . . .

♦   Gateway Modes

♦   Repeat Cycle

♦   Control Word

♦   Error Indication Bits

♦   Communication Parameters

4.1 Gateway Modes

Gateway has two modes of operation: Master-Master and Master-Slave. Before explaining these modes further Master and Slave concept should be explained.

Master:
Master is a Device / device driver which initiates communication.

Slave:
Slave is Device / Device driver which processes Master's query, takes necessary action and responds to the query, if necessary.

4.1.1 Master-Master Configuration

In this mode both Gateway ports are master in nature and devices connected on these ports are slave. Gateway ports initiate communication when the proper Gateway-Device communication cable is attached. Data is transferred in blocks. This transfer can either be a continuous process or as per requirement. A control word (Section 4.3), present in device on either side, enabled from Gateway Setup Software, can control the block execution.

When control word is disabled, then block transfer is a continuous process. A block of data is fetched from one device and transferred to the other device. The amount of data to be transferred (Number of words) depends on Block definition in "Block Definition Area" in Configuration Software. One block is executed at a time. A cycle consists of execution of blocks from #1 to #n.

Execution of blocks is performed as follows,

```
Block #1  ←──────┐
    │             │
    ↓             │
Block #2          ↑
    │             │
    ↓             │
Block #3          │
    │             │
    ↓             ↑
Block #4          │
    .             │
    .             │
    .             ↑
    .             │
    .             │
Block #n  ────────┘
```
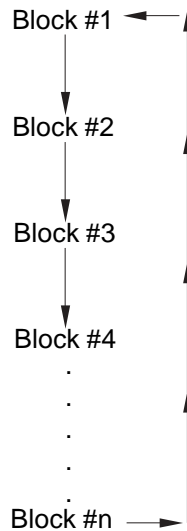
When Control word is enabled, it decides which block has to be executed by writing a specific data in the control word.

Note on Gateway CAN driver:

CAN driver uses total 3KBytes of Internal Memory. Memory is allocated to the each PGN according to the entry in the internal tag database(IDB). The number of bytes allocated to each PGN is mentioned in PGN Length column of IDB.

COM1 Any Serial Driver 3K Internal Database Memory	Gateway (Firmware System) Common Memory Area	COM2 CAN(J1939/71) driver 3KBytes of Internal Memory
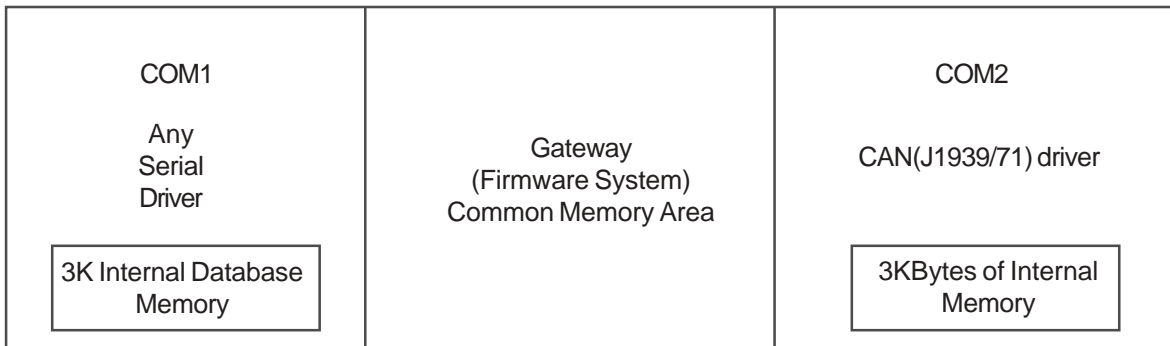
In background, if the received PGN having source address matches with the defined PGN in internal tag database having same EXT Device ID then this data is kept in internal memory of CAN driver. The data transfer between the serial driver and CAN is taken place through the common memory area. If serial device wants to read CAN data then corresponding data is bring in the common memory area which is then read by the serial driver.

Note:
For receiving any PGN on the CAN, while creating the project, the corresponding PGN (User wants to receive) should have 0 suffix.
For transmitting any PGN on the CAN, while creating the project, the corresponding PGN (User wants to transmit) should have 1 suffix.

Note:
CAN open slave operates in Master Slave mode only.

Let us see the example of Master-Master mode as shown in the picture below:

Configure Gateway ports as: PLC1 Protocol: Modbus (Gateway as Master)
PLC2 Protocol: CAN(J1939/71)

master-master mode.prj - Gateway - GWY-300(CAN Gateway)

File   Edit   View   Communication   Hardware Test   Help

Block No.	# Words/Bits	Source PLC	Source ID	Source Address	Destination PLC	Destination ID	Destination Address	Repeat ...	Comment
1	00004	Modbus(Gatewa...	1	400001	CAN(J1939/71)	1	P1:000F003	1	
2	00004	CAN(J1939/71)	1	P0:000F000	Modbus(Gatewa...	1	400005	1	

IDB FOR COM1	Node Address	Starting Address	DataType	#Words/Bits	Scaling Factor	Skip For # Cycle	Skip on Comm.Fail	Fail Value
	1	400001	Word	8	1	0	Yes	65535

IDB FOR COM2	Ext.Device-ID	PGN Number	DataType	#Words/Bits	PGN Length	Priority	Source(GWY)ID	Fail Value
	1	P1:000F003	Output	0	8	3	0	0
	1	P0:000F000	Input	0	8	6	0	0

Words defines number of registers to be read / written between two devices.
Block #1: Gateway reads 4 words starting from 400001 from Modbus and write these 4 words data to internal memory of CAN. Since this data is transmitted on CAN PGN with suffix "1" is selected(PGN: P1:000F003)
Block #2: Gateway reads 4 words corresponding to PGN P0:000F000 from internal memory of CAN and writes it to holding register starting from 400005.

As this example has only two blocks, Gateway will execute Block #1 after executing Block #2 continuing *this cycle forever.*

Note:
1) Internal tag database entry should be such that the total memory of CAN should not exceed more than 3KBytes. Care should be taken while creating the project.

4.1.2   Master-Slave   Configuration

In this mode, one of the Gateway ports is a master and other is the slave so the devices connected on these ports are slave and master respectively. Blocks do not control data transfer in this mode. Data transfer takes place only when Master Device, connected on slave port of Gateway, sends a request to read / write data. This mode requires mapping registers for data transfer. Mapping means defining one or multiple registers in the Slave Device corresponding to one or multiple registers in the Master Device. Mapping can be done using the Block definition area, so in this mode, any Block is used for mapping registers of the two devices.

In Block Definition area, # Words Field indicates number of registers to be mapped **_linearly_** from the starting addresses of the Source Device to the Destination Device. Maximum number of registers that can be mapped is 255, but this does not mean that Master Device has to read / write 255 registers in one command.

In one command Master can read / write registers from one Block only, so if multiple registers are to be read / written using a single command, # Words also limits the maximum number of registers to be read / written. Number of registers to be read /written in one command also depends on

>   - protocol of BOTH the devices
>   - Buffer capacity of Gateway.

Note: In case of CAN, only the single PGN is mapped with the corresponding register i.e.PGN length of corresponding PGN (may be 4 words or less) can be mapped with corresponding register. If #Words field entry is greater than PGN Length (may be 4 words) then the remaining words are not mapped with any PGN.

For CAN open slave project please refer section 6.2

Now let us take the example of Master-Slave mode(COMM1 slave):
Configure Gateway ports as: PLC1 Protocol - Modbus (Gateway as Slave)
>   PLC2 Protocol - CAN(J1939/71).

master-slave mode.prj - Gateway - GWY-300(CAN Gateway)

File   Edit   View   Communication   Hardware Test   Help

Block No.	# Words/Bits	Source PLC	Source ID	Source Address	Destination PLC	Destination ID	Destination Address	Repeat ...	Comment
1	4	Modbus(Gatewa...	1	400001	CAN(J1939/71)	1	P0:000F003	1	
2	1	Modbus(Gatewa...	1	400005 ▼	CAN(J1939/71)	1	P1:000F000 ▼	1	

IDB FOR COM1	Node Address	Starting Address	DataType	#Words/Bits	Scaling Factor	Skip For # Cycle	Skip on Comm.Fail	Fail Value

IDB FOR COM2	Ext.Device-ID	PGN Number	DataType	#Words/Bits	PGN Length	Priority	Source(GWY)ID	Fail Value
	1	P0:000F003	Input	0	8	3	0	0
	1	P1:000F000	Output	0	8	6	0	0

Block #1 maps 4 words of Modbus starting from 400001 to CAN(J1939/71) starting from P0:000F003.
Block #2 maps 1 word of Modbus starting from 400005 to CAN(J1939/71) starting from P1:000F000.

In above example, request from Modbus Master is executed as follows:
1. Modbus Master connected on serial port (COM1) sends command to Gateway for reading holding register 400001.
2. Gateway searches defined Blocks and checks whether this register is mapped to any CAN PGN.

In example, holding register 400001 is mapped to P0:000F003 in Block 1. Gateway accepts this command and sends the data corresponding to PGN P0:000F003.
Since P0:000F003 is of receiving type of PGN, user can not write data in this PGN.
In Block2, P1:000F000 is of transmitting type of PGN, which is mapped with 40005. As only one word is mapped user can write data in 40005.
4 words (PGN Length) corresponding to P0:000F003 are sent on CAN but only first two bytes of this PGN can be changed using Modbus register 40005, since only one word is mapped.

If Master sends a command to read / write a register not defined in any Block then Gateway sends exception response to master.

NOTES:

1)   **As Gateway Setup Software is common for both the Gateway Modes, titles in the Block Definition Area, may not be appropriate when using Gateway in Master - Slave mode (e.g. Source ID, Source PLC, Destination PLC).**

2)   **In Master - slave mode, If somebody mapped read only registers at destination end to any registers at source end, it's users responsibility that these registers are not going to be written by master.**

3)   **Internal tag database entry should be such that the total memory of CAN should not exceed more than 3KBytes. Care should be taken while creating the project.**

4.2   Repeat Cycle

User can control Block execution by using the Repeat Cycle field. This number decides whether the Block will be executed in each cycle. Larger the number lower the priority of the Block. Range for Repeat Cycle setting is 1-99.
Repeat Cycle = 1 ………… Highest priority
Repeat Cycle =99 …………Lowest priority

Repeat cycle is important when using Gateway in Master - Master mode. **If Gateway is used in Master - Slave mode, Repeat Cycle field should be kept as '1'.**

Repeat cycle defines the number of times a Block will be skipped while executing Blocks in a sequential manner. Block will not be executed for [Repeat Cycle - 1] cycles. So if Repeat Cycle for a Block is 1, it will be executed in each cycle whereas if Repeat Cycle is 2, then this Block will NOT be executed in alternate cycles.

For example, suppose Blocks are defined with following Repeat Cycles:

Block #1	Repeat Cycle = 1
Block #2	Repeat Cycle = 2
Block #3	Repeat Cycle = 3
Block #4	Repeat Cycle = 4

After power up, Cycles will be executed as follows:
Cycle 1:
    Block #1
    Block #2
    Block #3
    Block #4
Cycle 2:
    Block #1
Cycle 3:
    Block #1
    Block #2
Cycle 4:
    Block #1
    Block #3
Cycle 5:
    Block #1
    Block #2
    Block #4

4.3   Control Word

Another way of controlling Block execution is by use of the Control Words. 16 control words i.e. 255 control bits are available by which user can control 255 blocks. 0th Control bit corresponds 0th bit of control word 1, .., 16st Control bit corresponds 0st bit of control word 2,.., 255th Control bit corresponds 15th bit of control word 16. By default 0 to 255 control bits are mapped to 1 to 256 blocks. User can change value of the control bit. Control Word can be enabled or disabled in Gateway Configuration. Normally Control Word is disabled for a New project. It can be enabled just by clicking on check box in the setup software. Control Word can be chosen from any of the Devices connected.
If the Control Word field is enabled, for the control bit choosen in the project block, accordingly the number of words in the control field should be taken.
For example, if 36th Control bit is choosen to control the block then number of words in the Control Word field should be 3.
Number of control bits / 16 = Number of control words.
If Number of control bits % 16 != 0 (Non-zero so add 1 in the number of words in the control field) then Number of control words = Number of control words + 1

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In the above example, number of control bits are 36.

So 36 / 16 = 2 (Number of words in control field)

36%16 = 4 (i.e. Non-zero so add 1 in the number of words in the control field), so number of words in control field are 2+1 = 3. So number of words in the control field should be choosen as 3. For any block any control bit can be choosen.

Control Word can only be used in Master-Master mode since no continuous data transfer takes place in Master -Slave mode (data transfer only takes place on Master's request)

When the Control Word is disabled, Block execution is totally controlled by Repeat Cycle settings. When the Control Word is enabled, Block execution is controlled using discrete bits of that word.

> Bit 0 in control word controls execution of Block #1
> Bit 1 in control word controls execution of Block #2
> **:**
> Bit 15 in control word controls execution of Block #16

When a bit is high, '1', corresponding Block is executed depending on its Repeat Cycle. When a bit is low, '0', execution of corresponding Block is disabled.

4.4 Error Indication Bit

This feature enables detection of communication breaks during error free communication between Gateway and two devices. Communication breaks can occur due to no cable connection, wire faults, device power failure at both ends of Gateway. An Error bit can be designated in each external device connected to
Gateway. Using this bit, fault at the PLC1 end can be reported to PLC2 Device and fault at PLC2 end can be reported to PLC1 Device. When communication error occurs on PLC1, Gateway sets error bit in PLC2 device. *Error Indication Bit can only be used in Master-Master mode. In Master-Slave mode any error can easily be detected by a communication time out on the Master.*

Error indication bit can be enabled using Gateway configuration software. Normally Error bit is disabled for a New project. It can be enabled just by clicking on the check box in the setup software. Error indication bit can be enabled in both or any one of the Devices connected to Gateway. Error Indication bit is "OFF" to indicate error free communication. In case of communication error on PLC2, Gateway sets error bit on PLC1 port and vice versa.

4.5 Communication Parameters

Communication Parameters of Gateway can be set from configuration Software. This enables Gateway to readily communicate with any device. Communication parameters for PLC1 and PLC2 ports can be configured independently. This feature allows changes in Baud rate, Number. of stop bits, Parity etc. at any time without downloading the driver for that particular device. After the driver for a particular device is downloaded, the communication parameters can be changed simply by selecting new communication parameters and downloading the same project.

NOTE ON COMMUNICATION DRIVERS

NOTE ON COMMUNICATION DRIVERS

5.1   Note On Communication Drivers

How Gateway CAN(J1939/71) driver works?

CAN driver uses total 3KBytes of Internal Memory. Memory is allocated to the each PGN according to the entry in the internal tag database(IDB). The number of bytes allocated to each PGN is mentioned in PGN Length column of IDB.

COM1 Any Serial Driver 3K Internal Database Memory	Gateway (Firmware System) Common Memory Area	COM2 CAN(J1939) driver 3KBytes of Internal Memory
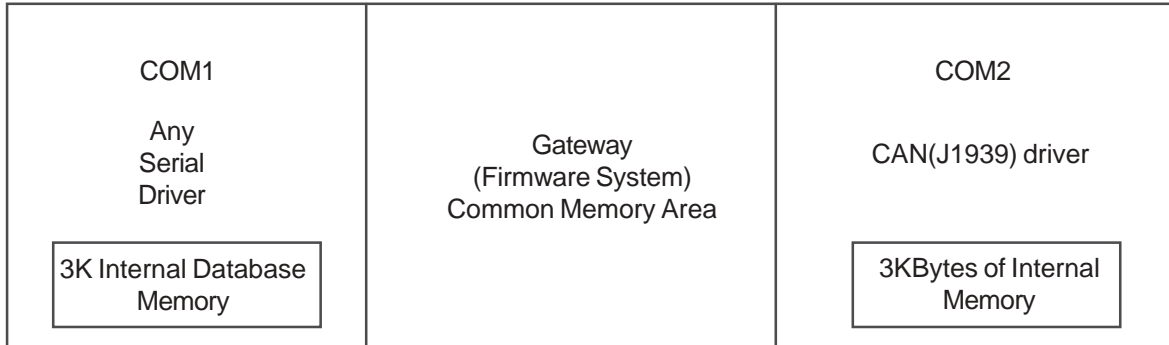
The total PGNs defined in actual project are automatically updated in the internal tag database with the corresponding information of the defined PGN. In background, if the received PGN having source address matches with the defined PGN in internal tag database having same EXT Device ID then this data is kept in internal memory of CAN driver.

Note:
For receiving any PGN on the CAN, while creating the project, the corresponding PGN (User wants to receive) should have 0 suffix.
For example, P**0**:000F000

For transmitting any PGN on the CAN, while creating the project, the corresponding PGN (User wants to transmit) should have 1 suffix.
For example, P**1**:000F000

How other serial drivers work?

Example1: Toshiba PLC or Modbus Master

Since drivers like Toshiba PLC, Modbus allow multiple register reading in one block, in this case concept of Internal Database* is used.

* Note: Concept of Internal database (IDB) is explained on next page.

Let us have a glance at Internal database.
Please refer the following example.

idb.prj - Gateway - GWY-300(CAN Gateway)

File Edit View Communication Hardware Test Help

Block No.	# Words/Bits	Source PLC	Source ID	Source Address	Destination PLC	Destination ID	Destination Address	Repeat ...	Comment
1	4	CAN(J1939/71)	1	P0:000F000	Modbus(Gatewa...	1	400001	1	
2	4	CAN(J1939/71)	1	P0:000F004	Modbus(Gatewa...	1	400005	1	
3	4	Modbus(Gatewa...	1	400010	CAN(J1939/71)	1	P1:000FEAC	1	

IDB FOR COM1	Node Address	Starting Address	DataType	#Words/Bits	Scaling Factor	Skip For # Cycle	Skip on Comm.Fail	Fail Value
	1	400001	Word	13	1	0	Yes	65535

IDB FOR COM2	Ext.Device-ID	PGN Number	DataType	#Words/Bits	PGN Length	Priority	Source(GWY)ID	Fail Value
	1	P0:000F000	Input	0	8	6	0	0
	1	P0:000F004	Input	0	8	3	0	0
	1	P1:000FEAC	Output	0	8	7	0	0

NOTE ON COMMUNICATION DRIVERS

According to the project defined in Gateway software, the Gateway software automatically generates its own IDB, (Gateway drivers use this IDB for optomized communication) as explained below.

1. Registers required for a project are grouped in a block of registers (calculation based optimized block) and entire block is read (By Gateway) in one cycle instead of reading individual registers.

4 words from 400001, 4 words from 400005, 4 words from 400010 are grouped in one block.
(Please refer the first block,IDB FOR COM1)

These blocks are uploaded/read in continuous fashion (in the background by Gateway driver) and data is stored in internal database memory. So time required for read cycle is optimized.

2.   Write operations are on comparison basis.
 Since all the registers data is already present in internal database memory of Gateway driver, every time before performing write operation data is compared with the internal memory data. In this way unnecessary write operations can be avoided.

The PLC2 driver uses this data whenever needed according to gateway project.

The Internal database is associated only with Master drivers. Every Master driver has its own internal database of 3KBytes. Data fetched by the master driver from external slave device is loaded into its internal memory in continuous fashion irrespective of block execution of Gateway project.

"Background communication Enable/Disable" default setting depends on PLC or Device protocol.

The speed of data transfer is improved because of Internal database since it reduces the number of block executions required by the Gateway software.

Background Read Operation   Write Operation

Write in Internal
Memory

Gateway

Master Driver

3KBytes
Internal
Database

CAN
(J1939/71)
Driver

Slave Device

Write in External
serial device

Compare
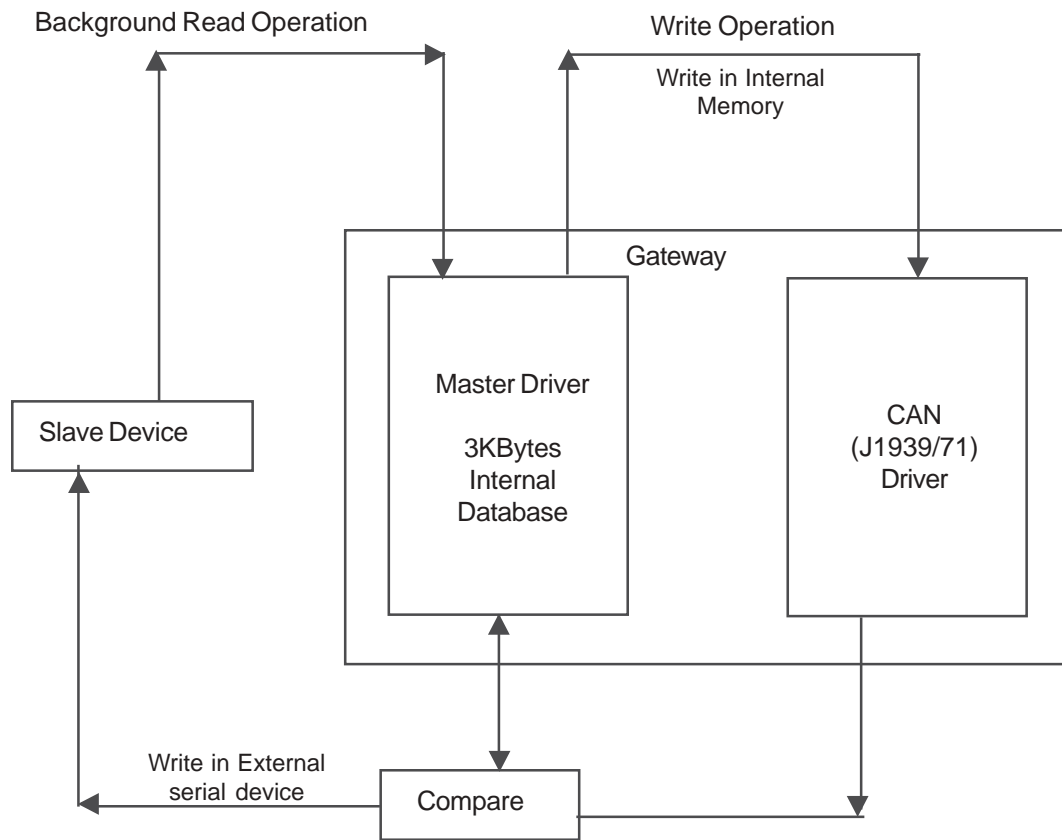
Above figure explains the operation of Master-Master mode with background communication.

At power on each master driver will get all inputs from their internal database Setup and according to that information starts fetching and loading data into its internal database memory irrepective of excution of project blocks.

The master driver will read all the data and load it into the internal database memory. But in case of write operation, each master driver will check the data available in the internal memory with the new data to be written. If the data in the internal memory is same as the new data, then Gateway software will skip the write command. In case of different data, master driver will initiate the write command.

TYPICAL PROJECTS AND APPLICATIONS

In this chapter. . . .

♦ Project Setup

♦ Applications

♦ Support for Diagnostics

6.1 Project Setup

This Chapter explains, how a simple Gateway project can be created and tested. To develop a Gateway system, select appropriate Gateway model depending on the system requirements. A new project can be created as follows:

User should follow the given seqence to configure and use GWY-300-B unit:
1. Install Gateway Setup Software.
2. Select GWY-300-B from product list.
3. Create a project using gateway software. Set Baud rate through PLC settings.For J1939 baud rate is 250Kbps. Source address for CAN port can be set through the PLC2 settings - advanced settings. For CAN driver, user selects the PGN as receiving PGN, then enter source ID or destination ID(For CAN Only) as the Source ID of the transmitting device.
Refer Application note for mapping the registers.
4. Connect IBM cable and CAN cable.
5. Power up the unit.

If current driver present for PLC1 port is Master (e.g. Modbus (Gateway as Master))

First, it is checked that whether device is connected on port1
If device is connected, it continues normal operation
If device is not connected, it checks for IBM download mode for 10sec.
This sequence continues until either is satisfied.

If current driver present for PLC1 port is Slave (e.g. Modbus (Gateway as Slave))

If Port1 of Gateway is Slave, all the configurations should be downloaded only at power on for 10sec.

6. Download Firmware, driver for the PLCs & project.
After downloading firmware, driver or project, software will ask to restart the unit. If user click on NO, then gateway will remain in Download mode. If user click on YES, then gateway unit is ready for application.

6.2 Applications

An on-vehicle gateway used to interface a J1939 network to an onboard industrial automation based control system supporting the Modbus protocol.
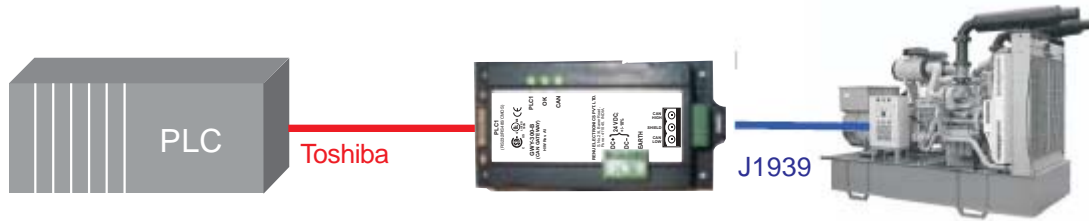
To create a new project mapping in Gateway can be done in following way-

Concept for mapping is same as GWY-00. Refer GWY-00 User Manual .
Single PGN defined in GWY-300 corresponds to 8 byte (4 word) data. Only single PGN (having defined PGN length- Mostly 4 words) is mapped at a time.
If the PGN is of receiving type, then while selecting the PGN, select "0" suffix.
If the PGN is of transmitting type, then while selecting the PGN, select "1" suffix.

Mapping for Gateway
1. Master - Slave mode (Modbus slave - CAN)

 PLC/SCADA acts as Modbus master & GWY-300-B as modbus slave.

For eg -
1. Modslave (40001) corresponds to PGN P0:000F001 and
No of words field contains 4 words i.e. Modbus Master on other side can read data of PGN P0:000F001 which receive on CAN. The destination ID Field (Next to destination field in the project) should contain the source ID of the device which transmits this PGN F001.

Please refer to Master-Slave configuration from Chapter 4.1.2

2. Master- Master Mode (e.g. Toshiba-CAN)

GWY-300-B acts as Toshiba Master.

For eg -
To read data on CANBUS and writes the data into the Toshiba PLC.

Select CAN as a Source PLC & Toshiba as destination PLC in gateway project.Only single PGN (having defined PGN length- Mostly 4 words) is mapped at a time.

Block execution is same as in GWY-00 Master – Master mode

Baud rate for com1 and com2 side can be set through the PLC Settings in the set up software.

NOTE: Defined PGNs in Internal tag database are kept in internal memory in same order as in the Internal tag database table.

3. Get Engine RPM and Engine Oil Temperature from Diesel Engine. Store RPM and oil temperature in PLC data registers. PLC should set an alarm bit on when RPM or oil temperature exceed presets.

First: Find the PGNs (parameter group numbers) that have the engine RPM and oil temperature.
    PGN for RPM is 61444 (OOF004), see page no-20, 7. Electronic Engine Controller
    PGN for Temp is 65262 (00FEEE), see page no-40, 45. Engine Oil Temperature

Note: Both of these PGNs map data across 8 bytes (4 PLC data registers).

Second: Use the Gateway setup software to create a program that maps RPM and Oil Temperature into the PLC data registers.

Block No.	# Wor...	Source PLC	Source ID	Source Address	Destination PLC	Desti...	Destination A...	Repeat ...	Comment
1	4	CAN(J1939/71)	1	P0:000F003	Toshiba T/Link ...	1	D00000	1	Data Register D0-D3
2	4	CAN(J1939/71)	1	P0:000FEEE	Toshiba T/Link ...	1	D00004	1	Data register D4-D5

IDB FOR COM1	Node Address	Starting Address	DataType	#Words/Bits	Scaling Factor	Skip For # Cycle	Skip on Comm.Fail	Fail Value
	1	D00000	Word	8	1	0	Yes	65535

IDB FOR COM2	Ext.Device-ID	PGN Number	DataType	#Words/Bits	PGN Length	Priority	Source(GWY)ID	Fail Value
	1	P0:000F003	Input	0	8	3	0	0
	1	P0:000FEEE	Input	0	8	6	0	0

F004 is selected from the given PGNs F000-F006 and FEEE is selected from given PGNs FEE4-FEEF

Third: Understand where RPM and Oil Temperature values are stored in the PLC data registers.

The data bytes of F004 are stored in D0-D3 as shown.

	High Byte	Low Byte
D000	Byte1 of F004 Status_EEC1	Byte2 of F004 Driver's demand engine - percent torque
D001	Byte3 of F004 Actual engine - percent torque	Byte4 of F004 Engine speed
D002	Byte5 of F004 Engine speed	Byte6 of F004 Not defined
D003	Byte7 of F004 Not defined	Byte8 of F004 Not defined

As per the description of F004 given in Appendix

Byte: 1 Status_EEC1   Bit: 8-5 Not defined
                                          4-1 Engine/retarder torque mode
          2 Driver's demand engine - percent torque
          3 Actual engine - percent torque
          4,5 Engine speed
          6-8 Not defined

In the same way FEEE data is also mapped to D4-D7.
The values seen in the PLC registers are with Offset and Multiplying factor.
So the actual values are calculated as follows:

(Value seen in the PLC register * Data resolution factor) - Offset

Data Resolution factor and Offset are given in the corresponding PGN description.

For Engine oil temperature

Data Length :2 bytes
Resolution :0.03125 °C/bit gain, -273 °C offset
Data Range :-273 to +1735.0 °C (-459.4 to 3155.0 °F)

The value seen for PLC data register is 'X'. Then the actual value is Y in ^{0}C=(X * 0.03125) -273 °C
The minimum and maximum values for Y are given in data range i.e -273 (min) & +1735 ^{0}C (max).

In this way the PLC registers are mapped with the CAN PGNs.

6.3 Support for Diagnostics

The GWY-300 is capable of supporting multi packet Diagnostic messages that is Active Diagnostic Codes (DTCs) in the form of SPN (Suspect Parameter Number) and FMI (Failure Mode Identifier) combinations. This is achieved with the use of the PGN 0xFECA. This PGN is used to transmit the current occurrences of Fault codes.

The current CAN gateway, GWY-300 supports the following:

1) The Data Link Layer   i.e. J1939-21.
2) The Application Layer i.e. J1939-71.
3) The Diagnostic messages J1939-73.

Most of the PGNs are of 8 byte length and hence do not require the support of the transportation layer. But there are some PGNs, which can have length more than 8 bytes (i.e. 9 up to 1785 bytes). Such PGNs require the support of the transporta-tion layer and the J1939-21 comes in to picture. It provides facilities like connection initiation, holding and termination for one to one to connection and broadcast message facilities all for multi packet transmission.
To implement multi packet transmission two schemes are provided:
1)   The broadcast message scheme.
2)   The RTS / CTS (Ready To Send/Clear To Send) scheme.

How does this operate?
 For the BAM message scheme the transmitter that wants to transmit a multi packet data sends a BAM (Broadcast Announce Message) declaring to all the other nodes. Now all the nodes interested in that data (details is obtained in the BAM message), accept that data while other nodes reject it. There is no connection initiation or Acknowledgement.

For RTS/CTS scheme: the transmitter sends the RTS frame to the concerned node which has to respond with a CTS frame and thereby setup a connection and data transfer takes place from the transmitter to the receiver. Several other frames may be send by the responder in between to keep the connection active. In the end, the responder sends an Acknowledge frame to indicate successful termination of the connection. For all successful/unsuccessful aborts, holding a connection, the responder is responsible and is in control of the line.

NOTE: 0xEC00 and 0xEB00 are PDU-I format and hence can be destination specific (0-254) / global (FF).

 The PGN 0xEC00 is used for the transportation layer. Its first byte is the control word that states whether this frame (i.e. 0xEC00) is a BAM, RTS, CTS, ACK or ABORT message.
This is followed by transmission of PGN 0xEB00, used for data transfer in transport layer, that carries the sequence num-ber, and seven data bytes of the multi packet frame.
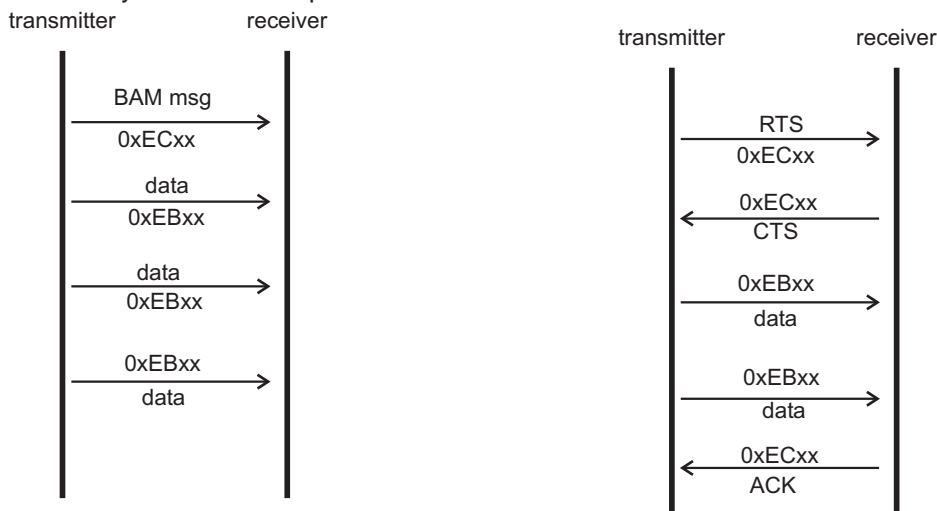
Currently the fault codes for the 'active diagnostic codes' and 'previously active diagnostic codes' are been supported. Hence, we provide the support for J1939-73.

But there are still some issues that are yet to be implemented in this gateway to completely support these protocols.
1) Currently the gateway supports the BAM message scheme only, for multi packet transmission. The RTS/ CTS scheme will be implemented on request.
2) Also the related timing constraint to hold or disconnect a connection is yet to be supported. For example, the 21 protocol states that data frame has to be received within 200ms after BAM message has been transmitted. This time constraint is not implemented in the gateway.
3) Our gateway currently supports maximum length of 500 bytes for multi packet frame transmission.

Diagnostic Message:
The GWY-300 supports the active diagnostics code via the PGN 0xFECA. This PGN is maybe of variable length and hence multipacketed too. This PGN supports Active Diagnostics i.e. Faults that are currently present. These faults are used to convey the fault cause and other related information as a combination of SPN , FMI and OC.
SPN: Suspect Parameter Number.
FMI: Failure Mode Identifier.
OC: Occurrence Count.

The first byte of the PGN 0xFECA always indicates the states of the Status Lamps used for faults for Diagnostics. From the 2nd byte onwards the Faults, also termed DTC (Diagnostic Trouble Codes) as follows:

Byte 1

Status lamps	SPN + FMI + OC for DTC 1	SPN + FMI + OC for DTC 2	⟶
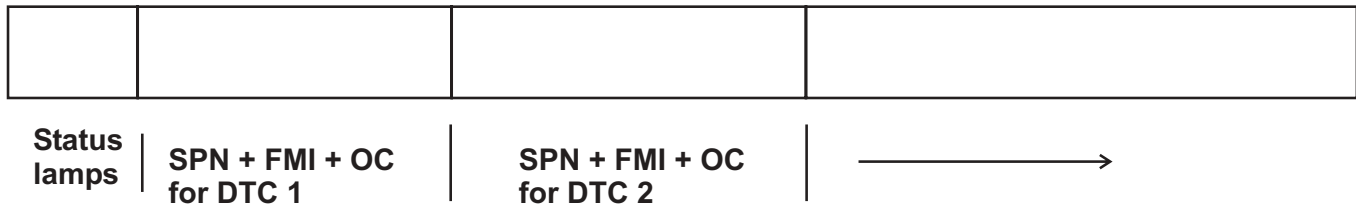
Example:

PGN 61443 (R) Electronic Engine Controller 2 - EEC2

Transmission Repetition 50 ms
Data Length: 8
Data Page: 0
PDU Format: 240
PDU Specific: 3 PGN Supporting Information:
Default Priority: 3
Parameter Group Number: 61443 (0xF003)

Start Position	Length	Parameter Name	SPN
1.1	2 bits	Accelerator Pedal 1 Low Idle Switch	558
1.3	2 bits	Accelerator Pedal Kickdown Switch	559
1.5	2 bits	Road Speed Limit Status	1437
1.7	2 bits	Accelerator Pedal 2 Low Idle Switch	2970
2	1 byte	Accelerator Pedal Position 1	91
3	1 byte	Engine Percent Load at Current Speed	92
4	1 byte	Remote Accelerator Pedal Position	974
5	1 byte	Accelerator Pedal Position 2	29
6.1	2 bits	Vehicle Acceleration Rate Limit Status	2979

Above are the SPN mentioned for several Parameters. Now when this fault occurs, the corresponding SPN along with the FMI is transmitted. The FMI as the name indicates gives the reason/ mode for the Fault. OC gives the number of times the Fault has occurred.

CONFIGURATION SOFTWARE

In this chapter...

♦ System Requirements

♦ Installation Instruction

CONFIGURATION SOFTWARE

7.1   System Requirements

System Requirement for Gateway setup software are:

Windows Version: Microsoft Windows XP / 2000, Windows 7 / VISTA (32/64 bits)
Processor: PENTIUM or higher
Hard disk Space: 5 MB or more
Serial Mouse: Required
RAM: 64 MB or more
Display resolution: 800 X 600 (VGA) or better
Display colors: 16 bit color

7.2   Installation Instruction

Use the following procedure to install the Microsoft Windows® based Gateway setup software This installation shows the procedure to install the software from a CD Disk on drive E. On machines with different drive configurations, change the names as needed. It is recommended that a backup disk of the Gateway setup software disk be created and stored in a safe place.

1. Launch the Windows operating system.
2. Insert the setup CD into CD-drive.
3. Point to the start button then click RUN
4. In the command line box enter E:\Disk1\setup.exe. Click OK. This will launch the Gateway installer.
5. Follow the instructions to complete setup.
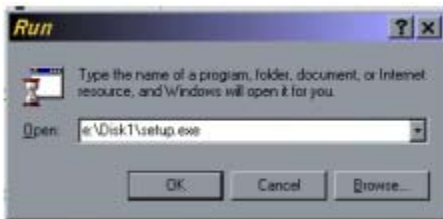
Gateway Project:
Each Gateway must be configured before connecting it to the PLC. Gateway configuration software allows the following:

     1. Create a new Gateway project
         - Select protocols for both communication ports of gateway.
         - Create blocks for data to be shared.
         - Set Communication Parameters for both the ports.
         - Set Control Word. (Optional)
         - Set Error Indication Bit, etc. (Optional)
     2. Downloading.
         - Download Project
         - Download drivers
         - Download new firmware, if required (only for upgrading).

     3. Upload Project.
         The existing project in the gateway module can be viewed/edited.
     4. Upload System Data.
         This option enables viewing of version number, status of firmware, drivers used, and boot block.

APPENDIX

In this chapter. . . .

♦   Parameter Group Number

♦   Description of PGNs

♦   Details of Rotochopper Application

♦   Toubleshooting

A   Parameter Group Number

The J1939 specification defines allowable messages by their Parameter Group Number (PGN). The Parameter Group Number is a 3-byte value that uniquely defines the message purpose. A PGN has the following format.

0	Reserved	Data page bit	PDU format	Group Extension
6 bits	1 bit	1 bit	8 bits	8 bits

Data transfered on the CAN bus is defined as Parameter Groups (PGs). PG's define where the data is located in the CAN Data frame, priority and transmission repetition rate. PG's are identified with Parameter Group Numbers (PGN's) . Parameters are grouped according to some similar characteristics into Parameter Groups and are expressed by its Parameter Group Number (PGN). This is the number used in J1939 to access the data about a particular parameter or a set of parameters.

Parameter group Number	Parameter Description
0x0000(00000)	TORQUE/SPEED CONTROL #1: TSC1
0xDE00 (56832)	RESET
0xE000(57344)	CAB MESSAGE #1: CM1
0xEA00(59904)	REQUEST PGN
0xEB00(60160)	TRANSPORT PROTOCOL - DATA TRANSFER (TP.DT)
0xEC00(60416)	TRANSPORT PROTOCOL CONNECTION MANAGEMENT (TP.CM)
0xF000(61440)	ELECTRONIC RETARDER CONTROLLER #1: ERC1
0xF001(61441)	ELECTRONIC BRAKE CONTROLLER #1: EBC1
0xF002(61442)	ELECTRONIC TRANSMISSIOIN CONTROLLER #1: ETC1
0xF003(61443)	ELECTRONIC ENGINE CONTROLLER #2: EEC2
0xF004(61444)	ELECTRONIC ENGINE CONTROLLER #1: EEC1
0xF005(61445)	ELECTRONIC TRANSMISSIOIN CONTROLLER #2: ETC2
0xF006(61446)	ELECTRONIC AXLE CONTROLLER #1: EAC1
0xFEAC(65196)	WHEEL BRAKE LINING REMAINING INFORMATION: EBC4
0xFEAD(65197)	WHEEL APPLICATION PRESSURE HIGH RANGE INFORMATION: EBC3
0xFEAE(65198)	SUPPLY PRESUURE
0xFEAF(65199)	FUEL CONSUMPTION (GASEOUS)
0xFEB1(655201)	ECU HISTORY
0xFEB2(65202)	FUEL INFORMATION (GASEOUS)

Parameter group Number	Parameter Description
0xFEB3(65203)	FUEL INFORMATION
0xFEB4(65204)	TRIP TIME INFORMATION #1
0xFEB5(65205)	TRIP SHUTDOWN INFORMATION
0xFEB6(65206)	TRIP VEHICLE SPPED/ CRUISE DISTANCE INFORMATION
0xFEBD(65213)	FAN DRIVE
0xFEBE(65214)	ELECTRONIC ENGINE CONTROLLER #4 : EEC4
0xFEBF(65215)	WHEEL SPEED INFORMATION
0xFEC0(65216)	SERVICE
0xFEC1(65217)	HIGH RESOLUTION VEHICLE DISTANCE
0xFEC2(65218)	ELECTRONIC RETARDER CONTROLLER #2:ERC2
0xFEC3(65219)	ELECTRONIC TRANSMISSION CONTROLLER #5:ETC5
0xFEC5(65221)	ELECTRONIC TRANSMISSION CONTROLLER #4:ETC4
0xFEC7(65223)	ELECTRONIC TRANSMISSION CONTROLLER #3:ETC3
0xFED5(65237)	ALTERNATOR SPEED
0xFED9(65241)	AUXILIARY DISCRIPT INPUT / OUTPUT STATUS
0xFEDB(65243)	ENGINE FLUID LEVEL / PRESSURE #2
0xFEDC(65244)	IDLE OPERATION
0xFEDD(65245)	TURBOCHARGER
0xFEDE(65246)	AIR START PRESSURE
0xFEDF(65247)	ELECTRONIC ENGINE CONTROLLER
0xFEE0(65248)	VEHICLE DISTANCE
0xFEE4(65252)	IDLE SHUTDOWN
0xFEE5(65253)	ENGINE HOURS, REVOLUTIONS
0xFEE6(65254)	TIME/DATE
0xFEE7(65255)	VEHICLE HOURS

Parameter group Number	Parameter Description
0xFEE8(65256)	VEHICLE DIRECTION/SPEED
0xFEE9(65257)	FUEL CONSUMPTION
0xFEEA(65258)	VEHICLE WEIGHT
0xFEED(65261)	CRUISE CONTROL/VEHICLE SPEED SET
0xFEEE(65262)	ENGINE TEMPERATURE
0xFEEF(65263)	ENGINE FLUID LEVEL/PRESSURE
0xFEF0 (65264)	POWER TAKEOFF INFORMATION
0xFEF1 (65265)	CRUISE CONTROL/VEHICLE SPEED
0xFEF2 (65266)	FUEL ECONOMY
0xFEF3 (65267)	VEHICLE POSITION
0xFEF4 (65268)	TIRE CONDITION
0xFEF5 (65269)	AMBIENT CONDITIONS
0xFEF6 (65270)	INLET/EXHAUST CONDITIONS
0xFEF7 (65271)	VEHICLE ELECTRICAL POWER
0xFEF8 (65272)	TRANSMISSION FLUIDS
0xFEF9 (65273)	AXLE INFORMATION
0xFEFA (65274)	BRAKES
0xFEFB(65275)	RETARDER FLUIDS
0xFEFC(65276)	DASH DISPLAY
0xFEFD(65277)	ALTERNATE FUEL #1
0xFEFE(65278)	AUXILIARY WATER PUPM PRESSURE
0xFEFF (65279)	WATER IN FUEL INDICATOR
0xFF00(65280)	PROPRIETARY B PGN

The above PGNs are kept in the ascending order in internal memory as shown .

If the user selects FED5 PGN and No of Words is 12 then he gets the data of FED5(4 words), FED9 (4 words) , FEDB(4 words) PGNs in the respective registers.

Note - GWY-300 receives messages in PDU2 format(Broadcasted messages) of one ECU only.

B   Description of Parameter Group Number

Note: If the PGN is mapped with the corresponding register of PLC, then the data length of PGN is considered. If PGN has 8 bytes and it is mapped with register e.g. Toshiba's D0000 to D0004, then high byte of D0000 contains first byte of PGN, low byte contains second byte,....,low byte of D0004 contains eighth byte of PGN. The sequence of bytes of PGN is defined as follows.

1. TORQUE/SPEED CONTROL #1: TSC1

Transmission repetition rate	:	when active; 10 ms to the engine - 50 ms to the retarder
Data length	:	8 bytes
Data page	:	0
PDU format	:	0
PDU specific	:	Destination address
Default priority	:	3
Parameter group number	:	0 (000000_{16})

Byte:	1	Control Bits
	2-3	Requested speed/Speed limit
	4	Requested torque/Torque limit
	5-8	Not defined

Bit:	8-7	Not defined
	6,5	Override control mode priority
	4,3	Requested speed control conditions
	2,1	Override control modes

Note: Retarder may be disabled by commanding a torque limit of 0%. For example, this permits the brake switch to enable the retarder, up to an amount selected by another device or the operator. Note that the brake switch can be treated as an operator input (mode 0001_2) or as a brake system input (mode 1010_2) relative to the active torque mode.

2. RESET

Transmission repetition rate	:	When needed
Data length	:	8 bytes
Data page	:	0
PDU format	:	222
PDU specific	:	Destination address
Default priority	:	7
Parameter group number	:	56,832 (**00DE00**$_{16}$)

Byte:	1	Trip reset
	2	Service component to reset
	3-8	Not defined

Bit:	8-5	Not defined
	4,3	Trip group 2 - Proprietary
	2,1	Trip group 1

Note:This message requires an Acknowledgement response (See J1939/21, 3.4.4) from the receiving node. The use of individual proprietary protocols can still be used instead of the "trip reset" PGN to maintain security.

3. CAB MESSAGE #1: CM1

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	224
PDU specific	:	Destination address
Default priority	:	6
Parameter group number	:	57,344 (**00E000**$_{16}$)

Byte:	1	Requested percent fan speed
	2-8	Not defined

4. REQUEST

Transmission repetition rate	:	Per user requirements, generally recommended that requests occur no more than 2 or 3 times per second.
Data length	:	3 bytes (The CAN frame for this PG shall set the DLC to 3.)
Data page	:	0
PDU format	:	234
PDU specific field	:	Destination Address (global or specific)
Default priority	:	6
Parameter group number	:	59,904 (**00EA00**$_{16}$)
Byte: 1, 2, 3	:	Parameter Group Number being requested

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5. TRANSPORT PROTOCOL DATA TRANSFER (TP.DT)

Transmission repetition rate	:	Per the Parameter Group to be transferred
Data length	:	8 bytes
Data page	:	0
PDU format	:	235
PDU specific field	:	Destination Address (Global (DA = 255) for TP.CM.BAM data transfers)
		(Global not allowed for RTS/CTS data transfers)
Default priority	:	7
Parameter group number	:	60,160 (**00EB00**$_{16}$)

Data ranges for parameters used by this Group Function:

Sequence Number: 1 to 255 (1 byte)

Byte: 1   Sequence Number

2-8   Packetized Data (7 bytes). Note the last packet of a multipacket Parameter Group may require less than 8 data bytes. The extra bytes should be filled with FF16.

6. TRANSPORT PROTOCOL CONNECTION MANAGEMENT (TP.CM)

Transmission repetition rate	:	Per the Parameter Group Number to be transferred
Data length	:	8 bytes
Data page	:	0
PDU format	:	236
PDU specific field	:	Destination Address
Default priority	:	7
Parameter group number	:	60,416 (**00EC00**$_{16}$)

Data ranges for parameters used by this Group Function:

Control byte	:	0-15, 18, 20-31, 33-254 are Reserved for SAE Assignment
Total Message Size, number of bytes:		9 to 1785 (2 bytes), zero to 8 and 1786 to 65535 not allowed
Total Number of Packets	:	2 to 255 (1 byte), zero not allowed
Maximum Number of Packets	:	2 to 255 (1byte), zero through 1 are not allowed
Number of Packets that can be sent:		0 to 255 (1 byte)
Next Packet Number to be Sent	:	1 to 255 (1 byte), zero not allowed
Sequence Number	:	1 to 255 (1 byte), zero not allowed

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7. ELECTRONIC RETARDER CONTROLLER #1: ERC1

Transmission repetition rate : 100 ms
Data length : 8 bytes
Data page : 0
PDU format : 240
PDU specific : 0
Default priority : 6
Parameter group number : 61,440 (**00F000**$_{16}$)

Note-This message can also be used by the engine exhaust brake. The distinction of engine brake and retarder is done by the source address.

Byte:	1	Status_ERC1	Bit:	8,7	Retarder enable - shift assist switch
				6,5	Retarder enable - brake assist switch
				4-1	Engine/retarder torque mode
	2	Actual retarder - percent torque			
	3	Intended retarder percent torque			
	4	Coolant load increase	Bit:	8-3	Not defined
				2,1	Engine coolant load increase
	5-8	Not defined			

8. ELECTRONIC BRAKE CONTROLLER #1: EBC1-Used for brake control information.

Transmission repetition rate : 100 ms
Data length : 8 bytes
Data page : 0
PDU format : 240
PDU specific : 1
Default priority : 6
Parameter group number : 61,441 (**00F001**$_{16}$)

Byte:	1	Status_EBC1	Bit:	8-7	Not defined
				6,5	ABS active
				4,3	ASR brake control active
				2,1	ASR engine control active
	2	Brake pedal position	Data Length:	1 byte	
			Resolution:	0.1%/bit gain, 0% offset	
			Data Range:	0-100%	
	3	Status_EBC2	Bit:	8-7	Not defined
				6,5	ASR "hill holder" switch
				4,3	ASR offroad switch
				2,1	ABS offroad switch
	4	Measured_Aux_1	Bit:	8,7	Remote accelerator enable switch
				6,5	Auxiliary engine shutdown switch
				4,3	Engine derate switch
				2,1	Accelerator interlock switch
	5	Engine retarder selection			
	6-8	Not defined			

9. ELECTRONIC TRANSMISSION CONTROLLER #1: ETC1

Transmission repetition rate	:	10 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	240
PDU specific	:	2
Default priority	:	3
Parameter group number	:	61,442 (**00F002**$_{16}$)

Byte: 1   Status_ETC1   Bit:
Bit	
8-7	Not defined
6,5	Shift in process
4,3	Torque converter lockup engaged
2,1	Driveline engaged

     2,3   Output shaft speed
Data Length:	2 bytes
Resolution:	0.125 rpm/bit gain, 0 rpm offset(Upper byte resolution:32 rpm/bit)
Data Range:	0 to +8031.875rpm

     4   Percent clutch slip
Data Length:	1 byte
Resolution:	0.4%/bit gain, 0% offset
Data Range:	0 to 100%

     5   Command_ETC1   Bit:
Bit	
8-5	Not defined
4,3	Progressive shift disable
2,1	Momentary engine overspeed enable

     6,7   Input shaft speed
Data Length:	2 byte
Resolution:	0-125rpm/bit gain, 0rpm offset
Data Range:	0 to +8031.875rpm

     8   Not defined

10. ELECTRONIC ENGINE CONTROLLER #2: EEC2

Transmission repetition rate	:	50 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	240
PDU specific	:	3
Default priority	:	3
Parameter group number	:	61,443 (**00F003**$_{16}$)

Byte: 1   Status_EEC2   Bit:
Bit	
8-5	Not defined
4-3	AP kickdown switch
2-1	AP low idle switch

     2   Accelerator pedal (AP) position
Data Length:	1 byte
Resolution:	0.4%/bit gain, 0% offset
Data Range:	0-100%

     3   Percent load at current speed
Data Length:	1 byte
Resolution:	1%/bit gain, 0% offset
Data Range:	0-125%

Byte   4   Remote accelerator   Data Length: 1 byte
                                         Resolution: 0-4%/bit gain, 0% offset
                                         Data Range: 0-100%

        5-8 Not defined

11. ELECTRONIC ENGINE CONTROLLER #1: EEC1

Transmission repetition rate   :   Engine speed dependent
Data length   :   8 bytes
Data page   :   0
PDU format   :   240
PDU specific   :   4
Default priority   :   3
Parameter group number   :   61,444 (**00F004**$_{16}$)

Byte: 1   Status_EEC1   Bit: 8-5   Not defined
                                        4-1   Engine/retarder torque mode
        2   Driver's demand engine - percent torque
        3   Actual engine - percent torque
        4,5 Engine speed
        6-8 Not defined

12. ELECTRONIC TRANSMISSION CONTROLLER #2: ETC2

Transmission repetition rate   :   100 ms
Data length   :   8 bytes
Data page   :   0
PDU format   :   240
PDU specific   :   5
Default priority   :   6
Parameter group number   :   61,445 (**00F005**$_{16}$)

Byte: 1   Selected gear   Data Length   :1 byte
                                Resolution   :1 gear value/bit, -125 offset
                                Data Range   :-125 to +125, negative values are reverse
                                                 gears, positive values are forward gears, zero
                                                 is neutral
                                Parameter Specific Indicator: FB16 is park

        2,3 Actual gear ratio Data Length   :2 bytes
                                Resolution   :0.001/bit, 0 offset
                                Data Range   :0 to 64.255

        4   Current gear   Data Length   :1 byte
                                Resolution   :1 gear value/bit, -125 offset
                                Data Range   :-125 to +125, negative values are reverse gears,
                                                 positive values are forward gears, zero is neutral
                                Parameter Specific Indicator: FB16 is park

5,6	Transmission requested range	Data Length	:2 bytes
		Resolution	:ASCII
		Data Range	:0 to 250 (each byte)

7,8	Transmission current range	Data Length	:2 bytes
		Resolution	:ASCII
		Data Range	:0 to 250 (each byte)

13. ELECTRONIC AXLE CONTROLLER #1: EAC1

Transmission repetition rate	:	500 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	240
PDU specific	:	6
Default priority	:	6
Parameter group number	:	61,446 (**00F006**$_{16}$)

Byte:	1	Location	Data Length	:1 byte
			Resolution	:Bit-mapped
			Data Range	:N/A

	2	Differential lock status 1	Bit:	8,7	Rear axle 2
				6,5	Rear axle 1
				4,3	Front axle 2
				2,1	Front axle 1
	3	Differential lock status 2	Bit:	8-7	Not defined
				6,5	Central rear
				4,3	Central front
				2,1	Central
	4-8	Not defined			

14. WHEEL BRAKE LINING REMAINING INFORMATION: EBC4

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	172
Default priority	:	7
Parameter group number	:	65,196 (**00FEAC**$_{16}$)

Byte:	1	Brake Lining Remaining, front axle, left wheel	Data Length	:1 byte
			Resolution	:0.4% per bit gain, 0% offset
			Data Range	:0% to 100%

	2	Brake Lining Remaining, front axle, right wheel	Data Length	:1 byte
			Resolution	:0.4% per bit gain, 0% offset
			Data Range	:0% to 100%

| 3 | Brake Lining Remaining, rear axle #1, left wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

| 4 | Brake Lining Remaining, rear axle #1, right wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

| 5 | Brake Lining Remaining, rear axle #2, left wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

| 6 | Brake Lining Remaining, rear axle #2, right wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

| 7 | Brake Lining Remaining, rear axle #3, left wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

| 8 | Brake Lining Remaining, rear axle #3, right wheel | Data Length
Resolution
Data Range | :1 byte
:0.4% per bit gain, 0% offset
:0% to 100% |

15. WHEEL APPLICATION PRESSURE HIGH RANGE INFORMATION: EBC3

Transmission repetition rate : 100 ms
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 173
Default priority : 6
Parameter group number : 65,197 (**00FEAD**$_{16}$)

Byte:	1	Brake application pressure high range, front axle, left wheel	Data Length Resolution Data Range	:1 byte :5 kPa per bit gain, 0 kPa offset :0 kPa to +1250 kPa (0 to 181 psi)
	2	Brake application pressure high range, front axle, right wheel	Data Length Resolution Data Range	:1 byte :5 kPa per bit gain, 0 kPa offset :0 kPa to +1250 kPa (0 to 181 psi)
	3	Brake application pressure high range, rear axle #1, left wheel	Data Length Resolution Data Range	:1 byte :5 kPa per bit gain, 0 kPa offset :0 kPa to +1250 kPa (0 to 181 psi)
	4	Brake application pressure high range, rear axle #1, right wheel	Data Length Resolution Data Range	:1 byte :5 kPa per bit gain, 0 kPa offset :0 kPa to +1250 kPa (0 to 181 psi)
	5	Brake application pressure high range, rear axle #2, left wheel	Data Length Resolution Data Range	:1 byte :5 kPa per bit gain, 0 kPa offset :0 kPa to +1250 kPa (0 to 181 psi)

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6	Brake application pressure high range, rear axle #2, right wheel	Data Length	:1 byte
		Resolution	:5 kPa per bit gain, 0 kPa offset
		Data Range	:0 kPa to +1250 kPa (0 to 181 psi)
7	Brake application pressure high range, rear axle #3, left wheel	Data Length	:1 byte
		Resolution	:5 kPa per bit gain, 0 kPa offset
		Data Range	:0 kPa to +1250 kPa (0 to 181 psi)
8	Brake application pressure high range, rear axle #3, right wheel	Data Length	:1 byte
		Resolution	:5 kPa per bit gain, 0 kPa offset
		Data Range	:0 kPa to +1250 kPa (0 to 181 psi)

16 SUPPLY PRESSURE

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	174
Default priority	:	6
Parameter group number	:	65,198 (**00FEAE**$_{16}$)

Byte:	1	Pneumatic supply pressure		
	2	Parking and/or trailer air pressure	Data Length	:1 byte
			Resolution	:8 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +2000 kPa (0 to 290 psi)
	3	Service brake air pressure, circuit #1	Data Length	:1 byte
			Resolution	:8 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +2000 kPa (0 to 290 psi)
	4	Service brake air pressure, circuit #2	Data Length	:1 byte
			Resolution	:8 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +2000 kPa (0 to 290 psi)
	5	Auxiliary equipment supply pressure	Data Length	:1 byte
			Resolution	:8 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +2000 kPa (0 to 290 psi)
	6	Air suspension supply pressure	Data Length	:1 byte
			Resolution	:8 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +2000 kPa (0 to 290 psi)
	7-8	Not defined		

17 FUEL CONSUMPTION (GASEOUS)

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	175
Default priority	:	7
Parameter group number	:	65,199 (**00FEAF$_{16}$**)

Byte:	1-4	Trip fuel	Data Length	:4 bytes
			Resolution	:0.5 kg per bit gain, 0 kg offset
			Data Range	:0 kg to +2 105 540 607.5 kg

	5-8	Total fuel used	Data Length	:4 bytes
			Resolution	:0.5 kg per bit gain, 0 kg offset
			Data Range	:0 kg to +2 105 540 607.5 kg

18 ECU HISTORY

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	177
Default priority	:	7
Parameter group number	:	65,201 (**00FEB1$_{16}$**)

Byte:	1-4	Total ECU distance	Data Length	:4 bytes
			Resolution	:0.125 km per bit, 0 km offset
			Data Range	:0 km to +526 385 151.9 km (0 mi to +327 080 569.4 mi)

	5-8	Total ECU run time	Data Length	:4 bytes
			Resolution	:0.05 h/bit, 0 h offset
			Data Range	:0 to 210 554 060.75 h

19 FUEL INFORMATION (GASEOUS)

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	178
Default priority	:	7
Parameter group number	:	65,202 (**00FEB2$_{16}$**)

Byte:	1-4	Total engine PTO fuel used	Data Length	:4 bytes
			Resolution	:0.5 kg per bit gain, 0 kg offset
			Data Range	:0 kg to +2 105 540 607.5 kg

5-6	Trip average fuel rate	Data Length	:2 bytes
		Resolution	:0.05 kg/h per bit gain, 0 kg/h offset
		Data Range	:0 kg/h to 3212.75 kg/h

7-8   Not defined

20 FUEL INFORMATION

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	179
Default priority	:	7
Parameter group number	:	65,203 (**00FEB3**$_{16}$)

Byte:	1-4	Total engine PTO fuel used	Data Length	:4 bytes
			Resolution	:0.5 L per bit gain, 0 L offset
			Data Range	:0 L to +2 105 540 607.5 L

	5-6	Trip average fuel rate	Data Length	:2 bytes
			Resolution	:0.05 L/h per bit gain, 0 L/h offset
			Data Range	:0 L/h to 3212.75 L/h

7-8   Not defined

21 TRIP TIME INFORMATION #1

Transmission repetition rate	:	On request
Data length	:	16 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	180
Default priority	:	7
Parameter group number	:	65,204 (**00FEB4**$_{16}$)

Byte:	1-2	Trip time in VSL	Data Length	:4 bytes
			Resolution	:0.05 h/bit, 0 h offset
			Data Range	:0 to 210 554 060.75 h

	3-4	Trip time in top gear	Data Length	:4 bytes
			Resolution	:0.05 h/bit, 0 h offset
			Data Range	:0 to 210 554 060.75 h

	5-6	Trip time in gear down	Data Length	:4 bytes
			Resolution	:0.05 h/bit, 0 h offset
			Data Range	:0 to 210 554 060.75 h

	7-8	Trip time in derate by engine	Data Length	:4 bytes
			Resolution	:0.05 h/bit, 0 h offset
			Data Range	:0 to 210 554 060.75h

22 TRIP SHUTDOWN INFORMATION

Transmission repetition rate : On request
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 181
Default priority : 7
Parameter group number : 65,205 (**00FEB5**$_{16}$)

Byte: 1-2 Trip number of hot shutdowns | Data Length | :2 bytes
| Resolution | :1 count per bit, 0 counts offset
| Data Range | :0 to 64 255 counts

3-4 Trip number of idle shutdowns | Data Length | :2 bytes
| Resolution | :1 count per bit, 0 counts offset
| Data Range | :0 to 64 255 counts

5-6 Trip number of idle shutdown overrides | Data Length | :2 bytes
| Resolution | :1 count per bit, 0 counts offset
| Data Range | :0 to 64 255 counts

7-8 Trip number of sudden decelerations | Data Length | :2 bytes
| Resolution | :1 count per bit, 0 counts offset
| Data Range | :0 to 64 255 counts

23 TRIP VEHICLE SPEED/CRUISE DISTANCE INFORMATION

Transmission repetition rate : On request
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 82
Default priority : 7
Parameter group number : 65,206 (**00FEB6**$_{16}$)

Byte: 1-2 Trip maximum vehicle speed | Data Length | :2 bytes
| Resolution | :1/256 kph per bit, 0 kph offset
| Data Range | :0 to 250.996 kph

3-6 Trip cruise distance | Data Length | :4 bytes
| Resolution | :0.125 km per bit, 0 km offset
| Data Range | :0 km to +526 385 151.9 km (0 mi to +327 080 569.4 mi)

7-8 Not defined

24 FAN DRIVE

Transmission repetition rate : 1 s
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 189
Default priority : 6
Parameter group number : 65,213 (**00FEBD**$_{16}$)

Byte: 1 Estimated percent fan speed Data Length :1 byte
Resolution :0.4%/bit gain, 0% offset
Data Range :0% to 100%

2 State_Fan_Drive Bit: 8-5 Not defined
4-1 Fan drive state

3-8 Not defined

25 ELECTRONIC ENGINE CONTROLLER #4: EEC4

Transmission repetition rate : On request
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 190
Default priority : 7
Parameter group number : 65,214 (**00FEBE**$_{16}$)

Byte: 1,2 Rated engine power Data Length :1 byte
Resolution :0.5 kW/bit, 0 kW offset (0.67 hp/bit, 0 hp offset)
Range :0 to 32 127.5 kW (0 to 43 083.7 hp)

3,4 Rated engine speed Data Length :1 byte
Resolution :0.125 rpm/bit, 0 offset
Range :0 to 8031.875 rpm

5-8 Not defined

26 WHEEL SPEED INFORMATION

Transmission repetition rate : 100 ms
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 191
Default priority : 6
Parameter group number : 65,215 (**00FEBF**$_{16}$)

Byte:	1,2	Front axle speed	Data Length Resolution Data Range	:2 bytes :1/256 km/h/bit gain, 0 km/h offset (1/412 mph/bit gain, 0 mph offset) upper byte resolution = 1.0 km/h/bit (0.62 mph/bit) :0 to 251 km/h (0 to 156 mph)
	3	Relative speed; front axle, left wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph
	4	Relative speed; front axle, right wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph)
	5	Relative speed; rear axle #1, left wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph)
	6	Relative speed; rear axle #1, right wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph)
	7	Relative speed; rear axle #2, left wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph)
	8	Relative speed; rear axle #2, right wheel	Data Length Resolution Data Range	:1 byte :1/16 km/h/bit gain, 7.8125 km/h offset (1/26 mph/bit gain, 4.844 mph offset) :-7.8125 km/h to +7.8125 km/h (-4.844 mph to +4.844 mph)

27 SERVIC-Transmitted with the service component identification that has the shortest distance or nearest time until the next service inspection.

Transmission repetition rate	:	On request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	192
Default priority	:	6
Parameter group number	:	65,216 (**00FEC0$_{16}$**)

Byte:	1	Service component identification	Data Length	:1 byte
			Resolution	:1 Component ID/bit
			Data Range	:0 to 250
	2,3	Service distance	Data Length	:2 bytes
			Resolution	:5 km/bit gain, -160 635 km offset (3.1 mi/bit gain, 99 593.7 mi offset)
			Data Range	:-160 635 to +160 640 km (-99 593.7 to +99 596.8 mi)
	4	Service component identification	Data Length	:1 byte
			Resolution	:1 Component ID/bit
			Data Range	:0 to 250
	5	Service delay/calendar time based	Data Length	:1 byte
			Resolution	:1 week/bit gain, -125 weeks offset
			Data Range	:-125 to +125 weeks
	6	Service component identification	Data Length	:1 byte
			Resolution	:1 Component ID/bit
			Data Range	:0 to 250
	7,8	Service delay/operational time based	Data Length	:2 bytes
			Resolution	:1 h/bit gain, -32 127 h offset
			Data Range	:-32 127 to 32 128 h

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28 HIGH RESOLUTION VEHICLE DISTANCE

Transmission repetition rate : 1 s
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 193
Default priority : 6
Parameter group number : 65,217 (**00FEC1**$_{16}$)

Byte:	1-4	High resolution total vehicle distance	Data Length	:4 bytes
			Resolution	:5 m/bit gain, 0 m offset (16.4 ft/bit gain, 0 ft offset)
			Data Range	:0 to +21 055 406 km (0 to 13 054 351.8 mi)
	5-8	High resolution trip distance	Data Length	:4 bytes
			Resolution	:5 m/bit gain, 0 m offset (16.4 ft/bit gain, 0 ft offset)
			Data Range	:0 to +21 055 406 km (0 to 13 054 351.8 mi)

29 ELECTRONIC RETARDER CONTROLLER #2: ERC2

Transmission repetition rate : 1 s when active; or on change of state
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 194
Default priority : 7
Parameter group number : 65,218 (**00FEC2**$_{16}$)

Byte:	1	Retarder_status	Bit:	8-3	Not defined
				2,1	Transmission output retarder
	2-8	Not defined			

30 ELECTRONIC TRANSMISSION CONTROLLER #5: ETC5

Transmission repetition rate : on request
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 195
Default priority : 7
Parameter group number : 65,219 (**00FEC3**$_{16}$)

Byte:	1	Range_switch	Bit:	8-5	Not defined
				4,3	Low range sense
				2,1	High range sense
	2	Direction_switch	Bit:	8-7	Not defined
				6,5	Forward switch
				4,3	Neutral switch
				2,1	Reverse switch

3-8   Not defined

31 ELECTRONIC TRANSMISSION CONTROLLER #4: ETC4

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	197
Default priority	:	7
Parameter group number	:	65,221 (**00FEC5$_{16}$**)

Byte:	1	Transmission synchronizer clutch value	Data Length	:1 byte
			Resolution	:0.4%/bit gain, 0% offset
			Data Range	:0 to +100%
	2	Transmission synchronizer brake value	Data Length	:1 byte
			Resolution	:0.4%/bit gain, 0% offset
			Data Range	:0 to +100%

3-8   Not defined

32 ELECTRONIC TRANSMISSION CONTROLLER #3: ETC3

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	199
Default priority	:	7
Parameter group number	:	65,223 (**00FEC7$_{16}$**)

Byte:	1	Shift finger gear position			Data Length	:1 byte
					Resolution	:0.4%/bit gain, 0% offset
					Data Range	:0 to +100%
	2	Shift finger rail position			Data Length	:1 byte
					Resolution	:0.4%/bit gain, 0% offset
					Data Range	:0 to +100%
	3	Shift_finger_status_1	Bit:	8-7	Not defined	
				6,5	Center rail indicator	
				4,3	Engagement indicator	
				2,1	Neutral indicator	
	4	Shift_finger_status_2	Bit	8,7	Gear actuator #2	
				6,5	Rail actuator #2	
				4,3	Gear actuator #1	
				2,1	Rail actuator #1	

5	Transmission_actuator_1	Bit:	8,7	Splitter indirect actuator
			6,5	Splitter direct actuator
			4,3	Range low actuator
			2,1	Range high actuator
6	Transmission_actuator_2	Bit:	8,7	Inertia brake actuator
			6,5	Defuel actuator
			4,3	Lockup clutch actuator
			2,1	Clutch actuator
7-8	Not defined			

33 ALTERNATOR SPEED

Transmission repetition rate : 1 s
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 213
Default priority : 6
Parameter group number : 65,237 (**00FED5**$_{16}$)

Byte: 1,2 Alternator speed Data Length :2 bytes
                                            Resolution :0.5 rpm gain, 0 rpm offset
                                            Data Range :0 to 32 127.5

        3-8 Not defined

34 AUXILIARY DISCRETE INPUT/OUTPUT STATUS

Transmission repetition rate : manufacturer defined, not faster than 100 ms
Data length : 8 bytes
Data page : 0
PDU format : 254
PDU specific : 217
Default priority : 6
Parameter group number : 65,241 (**00FED9**$_{16}$)

Byte:	1	I/O_Status1	Bit:	8,7	I/O channel #1
				6,5	I/O channel #2
				4,3	I/O channel #3
				2,1	I/O channel #4
	2	I/O_Status2	Bit:	8,7	I/O channel #5
				6,5	I/O channel #6
				4,3	I/O channel #7
				2,1	I/O channel #8
	3	I/O_Status3	Bit:	8,7	I/O channel #9
				6,5	I/O channel #10
				4,3	I/O channel #11
				2,1	I/O channel #12

4	I/O_Status4	Bit:	8,7	I/O channel #13
			6,5	I/O channel #14
			4,3	I/O channel #15
			2,1	I/O channel #16
			5,6	Auxiliary I/O channel #1
			7,8	Auxiliary I/O channel #2

35 ENGINE FLUID LEVEL/PRESSURE #2

Transmission repetition rate	:	0.5 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	219
Default priority	:	6
Parameter group number	:	65,243 (**00FEDB**$_{16}$)

Byte:	1,2	Injection control pressure	Data Length	:2 bytes
			Resolution	:1/256 MPa/bit gain, 0 MPa offset
			Data Range	:0 to +251 MPa (0 to 36 404 psi)
	3,4	Injector metering rail pressure	Data Length	:2 bytes
			Resolution	:1/256 MPa/bit gain, 0 MPa offset
			Data Range	:0 to +251 MPa (0 to 36 404 psi)
	5-8	Not defined		

36 IDLE OPERATION

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	220
Default priority	:	6
Parameter group number	:	65,244 (**00FEDC**$_{16}$)

Byte:	1-4	Total idle fuel used	Data Length	:4 bytes
			Resolution	:0.5 L per bit gain, 0 L offset
			Data Range	:0 to +2 105 540 607.5 L
	5-8	Total idle hours	Data Length	:4 bytes
			Resolution	:0.05 h/bit gain, 0 h offset
			Data Range	:0 to +210 554 060.75 h

37 TURBOCHARGER

Transmission repetition rate   :   1 sec
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   221
Default priority   :   6
Parameter group number   :   65,245 (**00FEDD**$_{16}$)

Byte: 1   Turbo oil pressure   Data Length   :1 byte
                                          Resolution   :4 kPa/bit gain, 0 kPa offset
                                          Data Range   :0 to +1000 kPa (0 to 145 psi)

         2,3   Turbo speed   Data Length   :2 bytes
                                          Resolution   :4 rpm/bit gain, 0 rpm offset
                                          Data Range   :0 to +257 020 rpm

         4-8   Not defined

38 AIR START PRESSURE

Transmission repetition rate   :   on request
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   222
Default priority   :   6
Parameter group number   :   65,246 (**00FEDE**$_{16}$)

Byte: 1   Air start pressure   Data Length   :1 byte
                                          Resolution   :4 kPa/bit gain, 0 kPa offset
                                          Data Range   :0 to +1000 kPa (0 to 145 psi)

         2-8   Not defined

39 ELECTRONIC ENGINE CONTROLLER #3: EEC3

Transmission repetition rate   :   250 ms
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   223
Default priority   :   6
Parameter group number   :   65,247 (**00FEDF**$_{16}$)

Byte: 1   Nominal friction - percent torque   Data Length   :1 byte
                                                     Resolution   :1%/bit gain, -125% offset
                                                     Data Range   :-125 to 125%
                                                      Operating Range:0 to 125%

2,3	Engine's desired operating speed	Data Length	:2 bytes	
		Resolution	:0.125 rpm/bit gain, 0 rpm offset (upper byte resolution = 32 rpm/bit)	
		Data Range	:0 to 8031.875 rpm	
4	Engine's operating speed asymmetry adjustment	Data Length	:1 byte	
		Resolution	:ratio	
		Range	:0 to 250	
5-8	Not defined			

40 VEHICLE DISTANCE

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	224
Default priority	:	6
Parameter group number	:	65,248 (**00FEE0**$_{16}$)

Byte:	1-4	Trip distance	Data Length	:4 bytes
			Resolution	:0.125 km/bit gain, 0 km offset
			Data Range	:0 to +526 385 151.9 km (0 to +327 080 569.4 mi)
	5-8	Total vehicle distance	Data Length	:4 bytes
			Resolution	:0.125 km/bit gain, 0 km offset
			Data Range	:0 to +526 385 151.9 km (0 to +327 080 569.4 mi)

41 IDLE SHUTDOWN

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	228
Default priority	:	6
Parameter group number	:	65,252 (**00FEE4**$_{16}$)

Byte:	1	Idle shutdown_1 Bit	8,7	Idle shutdown timer state
			6,5	Idle shutdown timer override
			4,3	Driver alert mode
			2,1	Engine has shutdown by system
	2	Idle shutdown_2 Bit	8,7	Idle shutdown timer function
			6-1	Not defined
	3	Refrigerant_press_1 Bit	8,7	Not defined
			6,5	Refrigerant high pressure switch
			4,3	Refrigerant low pressure switch
			2,1	A/C high pressure fan switch

4	Lamp_commands	Bit	8-3	Not defined
			2,1	Wait to start lamp
5	Engine shutdown_1	Bit	8,7	Engine protection shutdown timer state
			6,5	Engine protection shutdown override
			4,3	Engine shutdown approaching
			2,1	Engine has shutdown by protection system
6	Engine shutdown_2	Bit	8,7	Engine protection timer system configuration
			6-1	Not defined
7-8	Not defined			

42 ENGINE HOURS, REVOLUTIONS

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	229
Default priority	:	6
Parameter group number	:	65,253 (**00FEE5**$_{16}$)

Byte:	1-4	Total engine hours	Data Length	:4 bytes
			Resolution	:0.05 h/bit gain, 0 h offset
			Data Range	:0 to +210 554 060.75 h
	5-8	Total engine revolutions	Data Length	:4 bytes
			Resolution	:1000 r/bit gain, 0 r offset
			Data Range	:0 to +4 211 081 215 000 r

43 TIME/DATE

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	230
Default priority	:	6
Parameter group number	:	65,254 (**00FEE6**$_{16}$)

Byte:	1	Seconds	Data Length	:1 byte
			Resolution	:0.25 s/bit gain, 0 s offset
			Operating Range:0 to 59.75 s	
	2	Minutes	Data Length	:1 byte
			Resolution	:1 min/bit gain, 0 min offset
			Operating Range:0 to 59 min	
	3	Hours	Data Length	:1 byte
			Resolution	:1 h/bit gain, 0 h offset
			Operating Range:0 to 23 h	
	4	Month	Data Length	:1 byte
			Resolution	:1 month/bit gain, 0 month offset
			Operating Range:1 to 12 month	

	5	Day	Data Length	:1 byte
			Resolution	:0.25 day/bit gain, 0 day offset
			Operating Range	:0.25 to 31.75 day
	6	Year	Data Length	:1 byte
			Resolution	:1 year/bit gain, +1985 year offset
			Operating Range	:1985 to 2235 year
	7,8	Not defined		

44 VEHICLE HOURS

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	231
Default priority	:	6
Parameter group number	:	65,255 (**00FEE7**$_{16}$)

Byte:	1-4	Total vehicle hours	Data Length	:4 bytes
			Resolution	:0.05 h/bit gain, 0 h offset
			Data Range	:0 to +210 554 060.75 h
	5-8	Total power takeoff hours	Data Length	:4 bytes
			Resolution	:0.05 h/bit gain, 0 h offset
			Data Range	:0 to +210 554 060.75 h

45 VEHICLE DIRECTION/SPEED

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	232
Default priority	:	6
Parameter group number:		65,256 (**00FEE8**$_{16}$)

Byte:	1,2	Compass bearing	Data Length	:2 bytes
			Resolution	:1/128 degree/bit gain, 0 degree offset
			Data Range	:0 to +502 degrees
	3,4	Navigation-based vehicle speed	Data Length	:2 bytes
			Resolution	:1/256 km/h/bit gain, 0 km/h offset (1/412 mph/bit gain, 0 mph offset)
			upper byte resolution = 1.0 km/h/bit (0.62 mph/bit)
			Data Range	:0 to 251 km/h (0 to 156 mph)

5,6	Pitch		Data Length	:2 bytes
			Resolution	:1/128 degree/bit gain, -200 degrees offset
			Data Range	:-200 degrees (DESCENT) to +302 degrees (ASCENT)
7,8	Altitude		Data Length	:2 bytes
			Resolution	:0.125 m/bit gain, -2500 m offset
			Data Range	:-2500 to +5531.875 m
				(-8202.1 to +15 896.193 ft)

46 FUEL CONSUMPTION

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	233
Default priority	:	6
Parameter group number	:	65,257 (**00FEE9$_{16}$**)

Byte:	1-4	Trip fuel	Data Length	:4 bytes
			Resolution	:0.5 L per bit gain, 0 L offset
			Data Range	:0 to +2 105 540 607.5 L
	5-8	Total fuel used	Data Length	:4 bytes
			Resolution	:0.5 L per bit gain, 0 L offset
			Data Range	:0 to +2 105 540 607.5 L

47 VEHICLE WEIGHT

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	234
Default priority	:	6
Parameter group number	:	65,258 (**00FEEA$_{16}$**)

Byte:	1	Axle location	Data Length	:1 byte
			Resolution	:Bit-mapped
			Data Range	:N/A
	2,3	Axle weight	Data Length	:2 bytes
			Resolution	:0.5 kg/bit gain, 0 kg offset
			Data Range	:0 to +32 127.5 kg (0 to 70 829 lb)
	4,5	Trailer weight	Data Length	:2 bytes
			Resolution	:2.0 kg/bit gain, 0 kg offset
			Data Range	:0 to +128 510 kg (0 to 283 316 lb)

6,7	Cargo weight	Data Length	:2 bytes
		Resolution	:2.0 kg/bit gain, 0 kg offset
		Data Range	:0 to +128 510 kg (0 to 283 316 lb)

8   Not defined

48 CRUISE CONTROL/VEHICLE SPEED SETUP

Transmission repetition rate	:	on request
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	237
Default priority	:	6
Parameter group number	:	65,261 (**00FEED**$_{16}$)

Byte:	1	Maximum vehicle speed limit	Data Length	:1 byte
			Resolution	:1 km/h/bit gain, 0 km/h offset
			Data Range	:0 to +250 km/h (0 km/h to +155 mph)
	2	Cruise control high set limit speed	Data Length	:1 byte
			Resolution	:1 km/h/bit gain, 0 km/h offset
			Data Range	:0 to +250 km/h (0 km/h to +155 mph)
	3	Cruise control low set limit speed	Data Length	:1 byte
			Resolution	:1 km/h/bit gain, 0 km/h offset
			Data Range	:0 to +250 km/h (0 km/h to +155 mph)

4-8   Not defined

49 ENGINE TEMPERATURE

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	238
Default priority	:	6
Parameter group number	:	65,262 (**00FEEE**$_{16}$)

Byte:	1	Engine coolant temperature	Data Length	:1 byte
			Resolution	:1 °C/bit gain, -40 °C offset
			Data Range	:-40 to +210 °C (-40 to 410 °F)
	2	Fuel temperature	Data Length	:1 byte
			Resolution	:1 °C/bit gain, -40 °C offset
			Data Range	:-40 to +210 °C (-40 to 410 °F)

3,4	Engine oil temperature	Data Length	:2 bytes
		Resolution	:0.03125 °C/bit gain, -273 °C offset
		Data Range	:-273 to +1735.0 °C (-459.4 to 3155.0 °F)
8	Not defined		
5,6	Turbo oil temperature	Data Length	:2 bytes
		Resolution	:0.03125 °C/bit gain, -273 °C offset
		Data Range	:-273 to +1735.0 °C (-459.4 to 3155.0 °F)
7	Engine intercooler temperature	Data Length	:1 byte
		Resolution	:1 °C/bit gain, -40 °C offset
		Data Range	:-40 to +210 °C (-40 to 410 °F)

50 ENGINE FLUID LEVEL/PRESSURE

Transmission repetition rate	:	0.5 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	239
Default priority	:	6
Parameter group number	:	65,263 (**00FEEF$_{16}$**)

Byte:	1	Fuel delivery pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)
	2	Not defined		
	3	Engine oil level	Data Length	:1 byte
			Resolution	:0.4 %/bit gain, 0 % offset
			Data Range	:0 to +100 %
	4	Engine oil pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)
	5,6	Crankcase pressure	Data Length	:2 bytes
			Resolution	:7.8125 x 10-3 kPa/bit gain (1/128 kPa/bit), -250 kPa offset
			Data Range	:-250 to +251.99 kPa (-36.259 to +36.548 lbf/in2)
	7	Coolant pressure	Data Length	:1 byte
			Resolution	:2 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +500 kPa (0 to 72.5 psi)
	8	Coolant level	Data Length	:1 byte
			Resolution	:0.4 %/bit gain, 0 % offset
			Data Range	:0 to +100 %

51 POWER TAKEOFF INFORMATION

Transmission repetition rate	:	100 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	240
Default priority	:	6
Parameter group number	:	65,264 (**00FEF0$_{16}$**)

Byte: 1   Power takeoff oil temperature

           Data Length : 1 byte
           Resolution : 1 °C/bit gain, -40 °C offset
           Data Range : -40 to +210 °C (-40 to 410 °F)

         2,3   Power takeoff speed

           Data Length : 2 bytes
           Resolution : 0.125 rpm/bit gain, 0 rpm offset
           Data Range : 0 to +8031.875 rpm

         4,5   Power takeoff set speed

           Data Length : 2 bytes
           Resolution : 0.125 rpm/bit gain, 0 rpm offset
           Data Range : 0 to +8031.875 rpm

         6   Measured_PTO_1   Bit: 8,7   Not defined
                                                    6,5   Remote PTO variable speed control switch

                                                    4,3   Remote PTO preprogrammed speed control
                                                               switch
                                                    2,1   PTO enable switch

         7   Measured_PTO_2   Bit: 8,7   PTO accelerate switch
                                                    6,5   PTO resume switch
                                                    4,3   PTO coast/decelerate switch
                                                    2,1   PTO set switch

         8   Not defined

52 CRUISE CONTROL/VEHICLE SPEED

Transmission repetition rate	:	100 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	241
Default priority	:	6
Parameter group number	:	65,265 (**00FEF1$_{16}$**)

Byte: 1   Measured_SW1   Bit: 8-5   Not defined
                                                  4,3   Parking brake switch
                                                  2,1   Two speed axle switch

         2,3   Wheel-based vehicle speed

           Data Length : 2 bytes
           Resolution : 1/256 km/h/bit gain, 0 km/h offset (1/412
                                      mph/ bit gain, 0 mph offset)
           Upper byte resolution = 1.0 km/h/bit (0.62 mph/bit)
           Data Range : 0 to 251 km/h (0 to 156 mph)

4	Measured_CC_SW1	Bit:	8,7	Clutch switch
			6,5	Brake switch
			4,3	Cruise control enable switch
			2,1	Cruise control active

5	Measured_CC_SW2	Bit:	8,7	Cruise control accelerate switch
			6,5	Cruise control resume switch
			4,3	Cruise control coast switch
			2,1	Cruise control set switch

6   Cruise control set speed

Data Length   :1 byte
Resolution   :1 km/h/bit gain, 0 km/h offset
Data Range   :0 to +250 km/h (0 km/h to +155 mph)

| 7 | State_CC | Bit: | 8-6 | Cruise control state |
| | | | 5-1 | PTO state |

8	Measured_Idle_SW1	Bit:	8,7	Not defined
			6,5	Engine test mode switch
			4,3	Idle decrement switch
			2,1	Idle increment switch

53 FUEL ECONOMY

Transmission repetition rate   :   100 ms
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   242
Default priority   :   6
Parameter group number   :   65,266 (**00FEF2$_{16}$**)

Byte: 1,2   Fuel rate

Data Length   :2 bytes
Resolution   :0.05 L/h per bit gain, 0 L/h offset (13.9 x 10-6 L/s per bit)
Data Range   :0 to +3212.75 L/h

3,4   Instantaneous fuel economy

Data Length   :2 bytes
Resolution   :1/512 km/L per bit gain, 0 km/L offset
Data Range   :0 to +125.5 km/L

5,6   Average fuel economy

Data Length   :2 bytes
Resolution   :1/512 km/L per bit gain, 0 km/L offset
Data Range   :0 to +125.5 km/L

7,8   Not defined

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54 VEHICLE POSITION

Transmission repetition rate   :   5 s
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   243
Default priority   :   6
Parameter group number   :   65,267 (**00FEF3**$_{16}$)

Byte:	1-4	Latitude	Data Length	:4 bytes
			Resolution	:10-7 degree/bit gain, -210 degree offset
			Data Range	:-210 degrees (SOUTH) to + 211.108 122 degrees (NORTH)
	5-8	Longitude	Data Length	:4 bytes
			Resolution	:10-7 degree/bit gain, -210 degree offset
			Data Range	:-210 degrees (WEST) to + 211.108 121 degrees (EAST)

55 TIRE CONDITION

Transmission repetition rate   :   10 s
Data length   :   8 bytes
Data page   :   0
PDU format   :   254
PDU specific   :   244
Default priority   :   6
Parameter group number   :   65,268 (**00FEF4**$_{16}$)

Byte:	1	Location	Data Length	:1 byte
			Resolution	:Bit-mapped
			Data Range	:N/A
	2	Tire pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)
	3,4	Tire temperature	Data Length	:1 byte
			Resolution	:5 kPa per bit gain, 0 kPa offset
			Data Range	:0 kPa to +1250 kPa (0 to 181 psi)
	5-8	Not defined		

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56 AMBIENT CONDITIONS

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	245
Default priority	:	6
Parameter group number	:	65,269 (**00FEF5₁₆**)

Byte: 1   Barometric pressure
- Data Length : 1 byte
- Resolution : 0.5 kPa/bit gain, 0 kPa offset
- Data Range : 0 to +125 kPa (0 to +18.1 psi)

2,3   Cab interior temperature
- Data Length : 2 bytes
- Resolution : 0.03125 °C/bit gain, -273 °C offset
- Data Range : -273 to +1735.0 °C (-459.4 to 3155.0 °F)

4,5   Ambient air temperature
- Data Length : 2 bytes
- Resolution : 0.03125 °C/bit gain, -273 °C offset
- Data Range : -273 to +1735.0 °C (-459.4 to 3155.0 °F)

6   Air inlet temperature
- Data Length : 1 byte
- Resolution : 1 °C/bit gain, -40 °C offset
- Data Range : -40 to +210 °C (-40 to 410 °F)

7,8   Road surface temperature
- Data Length : 2 bytes
- Resolution : 0.03125 °C/bit gain, -273 °C offset
- Data Range : -273 to +1735.0 °C (-459.4 to 3155.0 °F)

57 INLET/EXHAUST CONDITIONS

Transmission repetition rate	:	0.5 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	246
Default priority	:	6
Parameter group number	:	65,270 (**00FEF6₁₆**)

Byte: 1   Particulate trap inlet pressure
- Data Length : 1 byte
- Resolution : 0.5 kPa/bit gain, 0 kPa offset
- Data Range : 0 to +125 kPa (0 to +18.1 psi)

2   Boost pressure
- Data Length : 1 byte
- Resolution : 2 kPa/bit gain, 0 kPa offset
- Data Range : 0 to +500 kPa (0 to 72.5 psi)

3   Intake manifold temperature
- Data Length : 1 byte
- Resolution : 1 °C/bit gain, -40 °C offset
- Data Range : -40 to +210 °C (-40 to 410 °F)

4	Air inlet pressure	Data Length	:1 byte
		Resolution	:2 kPa/bit gain, 0 kPa offset
		Data Range	:0 to +500 kPa (0 to 72.5 psi)

5	Air filter differential pressure	Data Length	:1 byte
		Resolution	:0.05 kPa/bit gain, 0 kPa offset
		Data Range	:0 to +12.5 kPa (0 to +1.8 psi)

6,7	Exhaust gas temperature	Data Length	:2 bytes
		Resolution	:0.03125 °C/bit gain, -273 °C offset
		Data Range	:-273 to +1735.0 °C (-459.4 to 3155.0 °F)

8	Coolant filter differential pressure	Data Length	:1 byte
		Resolution	:0.5 kPa/bit gain, 0 kPa offset
		Data Range	:0 to +125 kPa (0 to +18.1 psi)

58 VEHICLE ELECTRICAL POWER

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	247
Default priority	:	6
Parameter group number	:	65,271 (**00FEF7**$_{16}$)

Byte:	1	Net battery current	Data Length	:1 byte
			Resolution	:1.0 A/bit gain, -125 A offset
			Data Range	:-125 to +125 A

	2	Alternator current	Data Length	:1 byte
			Resolution	:1.0 A/bit gain, 0 A offset
			Data Range	:0 to +250 A

	3,4	Alternator potential (voltage)	Data Length	:2 bytes
			Resolution	:0.05 V/bit gain, 0 V offset
			Data Range	:0 to +3212.75 V

	5,6	Electrical potential (voltage)	Data Length	:2 bytes
			Resolution	:0.05 V/bit gain, 0 V offset
			Data Range	:0 to +3212.75 V

	7,8	Battery potential (voltage), switched	Data Length	:2 bytes
			Resolution	:0.05 V/bit gain, 0 V offset
			Data Range	:0 to +3212.75 V

59 TRANSMISSION FLUIDS

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	248
Default priority	:	6
Parameter group number	:	65,272 (**00FEF8**$_{16}$)

Byte:	1	Clutch pressure	Data Length	:1 byte
			Resolution	:16 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +4000 kPa (0 to 580 psi)
	2	Transmission oil level	Data Length	:1 byte
			Resolution	:0.4 %/bit gain, 0 % offset
			Data Range	:0 to +100 %
	3	Transmission filter differential pressure	Data Length	:1 byte
			Resolution	:2 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +500 kPa (0 to 72.5 psi)
	4	Transmission oil pressure	Data Length	:1 byte
			Resolution	:16 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +4000 kPa (0 to 580 psi)
	5,6	Transmission oil temperature	Data Length	:2 bytes
			Resolution	:0.03125 °C/bit gain, -273 °C offset
			Data Range	:-273 to +1735.0 °C (-459.4 to 3155.0 °F)
	7,8	Not defined		

60 AXLE INFORMATION

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	249
Default priority	:	6
Parameter group number	:	65,273 (**00FEF9**$_{16}$)

Byte:	1	Steering axle temperature	Data Length	:1 byte
			Resolution	:1 °C/bit gain, -40 °C offset
			Data Range	:-40 to +210 °C (-40 to 410 °F)
	2	Drive axle location	Data Length	:1 byte
			Resolution	:Bit-mapped
			Data Range	:N/A

3	Drive axle lift air pressure	Data Length	:1 byte
		Resolution	:4 kPa/bit gain, 0 kPa offset
		Data Range	:0 to +1000 kPa (0 to 145 psi)

4	Drive axle temperature	Data Length	:1 byte
		Resolution	:1 °C/bit gain, -40 °C offset
		Data Range	:-40 to +210 °C (-40 to 410 °F)

5-8   Not defined

61 BRAKES

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	250
Default priority	:	6
Parameter group number	:	65,274 (**00FEFA**$_{16}$)

Byte:	1	Brake application pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)

	2	Brake primary pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)

	3	Brake secondary pressure	Data Length	:1 byte
			Resolution	:4 kPa/bit gain, 0 kPa offset
			Data Range	:0 to +1000 kPa (0 to 145 psi)

	4	Brake_status	Bit:	8-3	Not defined
				2,1	Parking brake actuator
	5-8	Not defined			

62 RETARDER FLUIDS

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	251
Default priority	:	6
Parameter group number	:	65,275 (**00FEFB**$_{16}$)

Byte: 1   Hydraulic retarder pressure   Data Length   :1 byte
                                                     Resolution   :16 kPa/bit gain, 0 kPa offset
                                                     Data Range   :0 to +4000 kPa (0 to 580 psi)

Byte: 2   Hydraulic retarder oil temperature   Data Length   :1 byte
                                                     Resolution   :1 °C/bit gain, -40 °C offset
                                                   Data Range   :-40 to +210 °C (-40 to 410 °F)

3-8   Not defined

63 DASH DISPLAY

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	252
Default priority	:	6
Parameter group number	:	65,276 (**00FEFC**$_{16}$)

Byte: 1   Washer fluid level   Data Length   :1 byte
                                                     Resolution   :0.4 %/bit gain, 0 % offset
                                                 Data Range   :0 to +100 %

Byte: 2   Fuel level   Data Length   :1 byte
                                                 Resolution   :0.4 %/bit gain, 0 % offset
                                               Data Range   :0 to +100 %

Byte: 3   Fuel filter differential pressure   Data Length   :1 byte
                                                 Resolution   :2 kPa/bit gain, 0 kPa offset
                                               Data Range   :0 to +500 kPa (0 to 72.5 psi)

Byte: 4   Engine oil filter differential pressure   Data Length   :1 byte
                                                 Resolution   :0.5 kPa/bit gain, 0 kPa offset
                                               Data Range   :0 to +125 kPa (0 to +18.1 psi)

Byte: 5,6   Cargo ambient temperature   Data Length   :2 bytes
                                                 Resolution   :0.03125 °C/bit gain, -273 °C offset
                                             Data Range   :-273 to +1735.0 °C (-459.4 to 3155.0 °F)

7-8   Not defined

64 ALTERNATE FUEL #1

Transmission repetition rate	:	500 ms
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	253
Default priority	:	6
Parameter group number	:	65,277 (**00FEFD$_{16}$**)

Byte: 1   Blower bypass valve position   Data Length :1 byte
                                              Resolution :0.4 %/bit gain, 0 % offset
                                              Data Range :0 to +100 %

2,3   Gas supply pressure   Data Length :2 bytes
                                              Resolution :0.5 kPa/bit gain, 0 kPa offset
                                              Data Range :0 to +32 127.5 kPa (0 to 4 659.7 psi)

2-8   Not defined

65 AUXILIARY WATER PUMP PRESSURE

Transmission repetition rate	:	1 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	254
Default priority	:	6
Parameter group number	:	65,278 (**00FEFE$_{16}$**)

Byte: 1   Auxiliary pump pressure   Data Length :1 byte
                                              Resolution :16 kPa/bit gain, 0 kPa offset
                                              Data Range :0 to +4000 kPa (0 to 580 psi)

2-8   Not defined

66 WATER IN FUEL INDICATOR

Transmission repetition rate	:	10 s
Data length	:	8 bytes
Data page	:	0
PDU format	:	254
PDU specific	:	255
Default priority	:	6
Parameter group number	:	65,279 (**00FEFF$_{16}$**)

Byte: 1   Water in fuel indicator   Bit: 8-3   Not defined
                                           2,1   Water in fuel indicator

2-8   Not defined

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67 PROPRIETARY B PGN

Transmission repetition rate	:	Per user requirements
Data length	:	0 to 1785 bytes (multipacket supported)
Data Page	:	0
PDU Format	:	255
PDU Specific	:	Group Extension (manufacturer assigned)
Default priority	:	6
Parameter Group Number	:	65280 to 65535 (**00FF00$_{16}$ to 00FFFF$_{16}$**)
Byte	:	1-8 Manufacturer defined usage

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C   Details of Rotochopper Application

This is the customized application. There are two option available in the COM2 Protocol list.
1. CAN(J1939/71)
2. CAN(J1939/71For Rotochopper)

First option CAN(J1939/71) is the generic CAN (J1939/71) Protocol. That means all the PGNs defined in the Appendix A are available and can be mapped to any register. The mapping is explained in Chapter 6.

For e.g.: If user wants to map a PGN of 8 bytes to registers, then mapping is, first two bytes of PGN mapped with first register, next two bytes are mapped with second register and so on.

In the second option, according to the Customer's specifications only few PGNs are defined and mapping is done accordingly. This is for single node application. The list of PGNs and their mapping for this application is as follows:

CAN Parameter Mapping to Modbus Registers and Toshiba PLC Registers:

CAN Group Number	Parameter Description	Modbus Register	Toshiba Register
00F003 (#EEC2)	Status_EEC2 Accelarator Pedal (AP)Position Percent load at current speed Remote accelerator Not Defined	40001 40002 40003 40004	D0000 D0001 D0002 D0003
00F004 (#EEC1)	Status_EEC1 Driver's demand Engine-percent Torque Actual Engine -percent Torque Engine Speed Not Defined	40005 40006 40007 40008	D0004 D0005 D0006 D0007
00FEBD (#FAN Drive)	Estimated Percent Fan Speed State_Fan_Drive Not Defined	40009 40010	D0008 D0009
00FEDB (#Engine Fluid Level Pressure)	Injection control pressure Injector metering rail pressure Not Defined	4011 4012	D0010 D0011
00FEE0 (Vehicle Distance)	Trip Distance Total Vehicle distance	4013(Hi Word) 4014(Low Word) 4015(Hi Word) 4016(Low Word)	D0012(Hi Word) D0013(Low Word) D0014(Hi Word) D0015(Low Word)
00FEE5 (Engine Hours, Revolutions)	Total Engine houres Total Engine Revolutions	4017(Hi Word) 4018(Low Word) 4019(Hi Word) 4020(Low Word)	D0015(Hi Word) D0016(Low Word) D0017(Hi Word) D0019(Low Word)

CAN Group Number	Parameter Description	Modbus Register	Toshiba Register
00FEE9 (Fuel Consumption)	Trip Fuel Total Fuel Used	4021(Hi Word) 4022(Low Word) 4023(Hi Word) 4024(Low Word)	D0020(Hi Word) D0021(Low Word) D0022(Hi Word) D0023(Low Word)
00FEEE (Engine Temperature)	Engine Coolant Temperature Fuel Temperature Engine Oil Temparature Turbo Oil Tempearture Engine Intercooler Temperature Not Defined	40025 40026 40027 40028 40029	D0024 D0025 D0026 D0027 D0028
00FEEF (Engine Fluid Level /Pressure)	Fuel Delivery Pressure Not Definned Engine Oil Level Engine Oil Pressure Crankcase Pressure Coolant Pressure Coolant Level	40030 40031 40032 40033 40034 40035	D0029 D0030 D0031 D0032 D0033 D0034
00FEF1 (Cruise Control /Vehicle speed)	Measured_SW1 Wheel-based vehicle speed Measured_CC_SW1 Measured_CC_SW2 Cruise control set speed State_CC Measured_Idle_SW1	40036 40037 40038 40039 40040 40041 40042	D0035 D0036 D0037 D0038 D0039 D0040 D0041
00FEF2 (Fuel Economy)	Fuel Rate Instantaneous fuel economy Average fuel economy Not Defined	40043 40044 40045	D0042 D0043 D0044
00FEF5 (Ambient Conditions)	Barometric Pressure Cab Interior temperature Ambient air Temperature Air Inlet Temperature Road surface temperature	40046 40047 40048 40049 40050	D0045 D0046 D0047 D0048 D0049
00FEF6 (Inlet/Exhaust Conditions)	Particulate trap inlet pressure Boost Pressure Intake manifold temperature Air inlet pressure Air filter differential pressure Exhaust gas temperature Coolant filter differential pressure	40051 40052 40053 40054 40055 40056 40057	D0050 D0051 D0052 D0053 D0054 D0055 D0056

| CAN Group Number	Parameter Description	Modbus Register	Toshiba Register
00FEF7 (Vehicle Electrical Power)	Net Battery Current Alternator Current Alternator Potential(voltage) Electrical Potential(voltage) Battery Potential(voltage),switched	40058 40059 40060 40061 40062	D0057 D0058 D0059 D0060 D0061
00FEF8 (Transmission Fluids)	Clutch pressure Transmission oil level Transmission filter differential pressure Transmission oil pressure Transmission oil temperature Not Defined	40063 40064 40065 40066 40067	D0062 D0063 D0064 D0065 D0066

D   Troubleshooting

If you do not know the ID of your ECU:

Point To Point Communication:
If ONLY TWO nodes will communicate with one another :one our Gateway and the other say for e.g. an ECU (Electronic Control Unit) of an Engine whose station ID is unknown, Enable the Point-to-Point Communication by making the following tab as one. Now irrespective of the Station ID of the ECU communication will take place successfully.
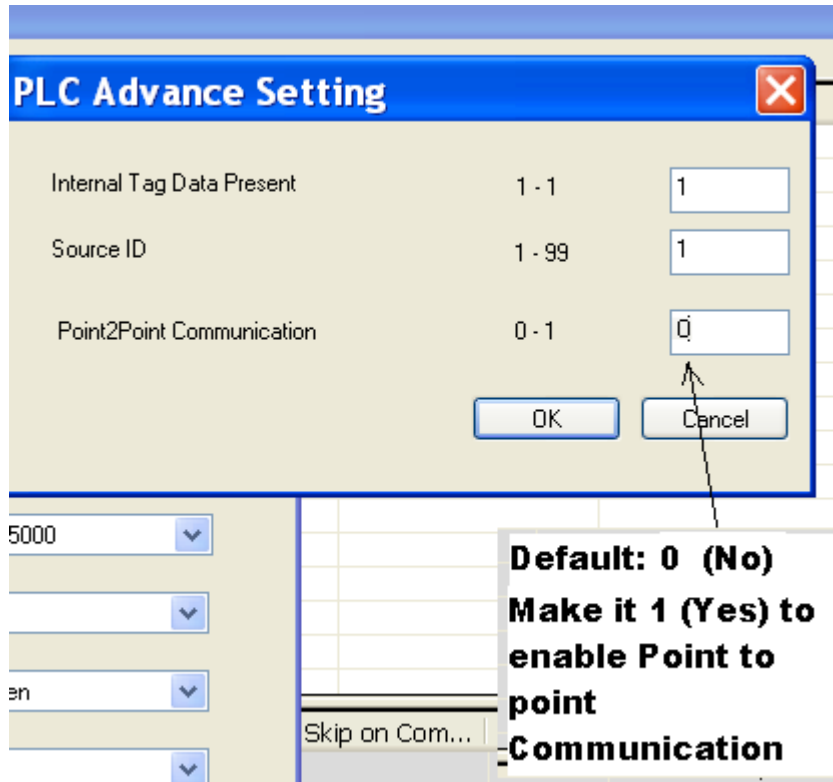
If CAN LED is not blinking:

The CAN led is for indicating that proper communication has been enabled on the CAN network. If it does not blink after downloading the 2 probable reasons could be:
1)   Improper selection of Baud Rate in the PLC2 Settings in the Project file.
2)   Improper Termination, this can be solved by using a 120ohm resistor at the CAN terminal on the GWY-300 CAN port.

Now the CAN Led blinking is an indication that the communication is right. So if the LED blinks and yet data is not available indicates that the Station ID of the external device and the one entered in the Target ID column of the downloaded project do not match. As mentioned earlier if only two nodes are been used Point To Point Communication can be enabled else the right value (of the station ID) has to be determined and used in the project.

Note:
For receiving any PGN on the CAN, while creating the project, the corresponding PGN (User wants to receive) should have 0 suffix.
For example, P**0**:000F000

For transmitting any PGN on the CAN, while creating the project, the corresponding PGN (User wants to transmit) should have 1 suffix.
For example, P**1**:000F000

If serial data is not displayed on CAN:

For receiving any PGN on the CAN, while creating the project, the corresponding PGN (User wants to receive) should have 0 suffix.
For example, **P0**:000F000

For transmitting any PGN on the CAN, while creating the project, the corresponding PGN (User wants to transmit) should have 1 suffix.
For example, **P1**:000F000