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## TABLE OF CONTENTS

<b>1</b>	<b>General.....</b>	<b>4</b>
1.1	Abbreviations .....	4
1.1.1	General .....	4
1.1.2	Galley Network Controller .....	7
1.1.3	Electrical Galley Inserts.....	7
1.1.4	CAN-Messages .....	7
1.2	Terms.....	8
1.3	Definitions .....	9
1.4	Data Format .....	9
1.5	Coding .....	9
1.5.1	Binary Unsigned.....	9
1.5.2	Binary Signed.....	10
1.5.3	Example .....	10
1.6	Transmission Rules.....	10
1.6.1	Status Data .....	10
1.7	Transfer Rate .....	11
1.8	Maximum Bus Load .....	11
1.9	Automatic Resets .....	12
1.10	Periodic Health Status Message (PHSM_GAIN / PHSM_MGCU).....	12
<b>2</b>	<b>Electrical Galley Inserts.....</b>	<b>13</b>
2.1	CAN-Bus Definition .....	13
2.2	Message Numbering .....	13
2.3	GAIN Configuration Datablock .....	16
2.3.1	Block 1 GAIN Standard .....	16
2.3.2	Block 2 GAIN Functionality.....	17
2.3.3	Block 3 GAIN Power Thresholds .....	18
2.3.4	Block 4 GAIN Partial Power Capabilities .....	19
2.3.5	Block 5 GAIN Data .....	20
2.3.6	Block 6 GAIN Maintenance Data.....	22
2.3.7	Block 7 GAIN Catering Data.....	22
2.3.8	Block 8 GAIN Flight Data .....	24
2.3.9	Block 9 GAIN Timer .....	25
2.3.9.1	GAIN Timer Default Values .....	26
2.3.10	Block 10 .....	26
2.3.11	Block 11 .....	26
2.3.12	Block 12 Counter Management .....	26
2.3.12.1	Block 12 Counter Management Default Values .....	27
2.4	MGCU Configuration Datablock .....	28
2.4.1	Block 1 .....	28
2.4.2	Block 2 MGCU Functionality.....	28
2.4.3	Block 3 .....	29
2.4.4	Block 4 .....	29
2.4.5	Block 5 .....	29
2.4.6	Block 6 MGCU Maintenance Data.....	29
2.4.7	Block 7 .....	30
2.4.8	Block 8 Flight Data .....	30
2.4.9	Block 9 .....	31
2.4.10	Block 10 MGCU Timer .....	31
2.4.10.1	Block 10 MGCU Timer Default Values .....	31
2.4.11	Block 11 .....	32
2.4.12	Block 12 Counter Management .....	32

2.4.12.1	Block 12 Counter Management Default Value .....	32
<b>3</b>	<b>Galley Network Functions .....</b>	<b>34</b>
3.1	General .....	34
3.2	System Configuration Data .....	34
3.3	Network Monitoring .....	34
3.3.1	Overview .....	34
3.3.2	Message List .....	35
3.3.2.1	Transmission/Reception .....	35
3.3.2.2	MGCU Life Pulse Status STA_MGCU .....	35
3.3.2.3	Data Field Format .....	37
3.3.2.4	GAIN Life Pulse State STA_GAIN .....	41
3.3.2.5	Flight Information FLIGHT_INFO .....	48
3.3.2.6	Flight Data .....	50
3.3.3	System Expanded Service (SES Messages) .....	51
3.3.3.1	SES_MGCU Message .....	51
3.3.3.2	SES_GAIN Message .....	52
3.4	Data Transfer .....	53
3.4.1	Overview .....	53
3.4.2	Data Transfer Protocol .....	55
3.4.2.1	Service Function Codes .....	58
3.4.2.2	Data Transfer CAN Message Request Identifier .....	58
3.4.2.3	Data Transfer CAN Message Response Identifier .....	58
3.4.2.4	Data Transfer CAN Message Data Identifier .....	59
3.4.2.5	Data Transfer Message Packet .....	59
3.4.3	Data Upload Service .....	59
3.4.3.1	Data Upload Request Message .....	60
3.4.3.2	Data Upload Response Message .....	61
3.4.3.3	Data Upload Request Message #2 .....	62
3.4.3.4	Data Upload Response Message #2 .....	64
3.4.3.5	Data Upload Acknowledge Response #2 .....	64
3.4.4	Data Download Service .....	64
3.4.4.1	Data Download Request Message .....	65
3.4.4.2	Data Download Response Message .....	66
3.4.4.3	Data Download Request Message #2 .....	66
3.4.4.4	Data Download Response Message #2 .....	68
3.4.4.5	Data Download Acknowledge Response Message .....	69
3.4.5	Maintenance Peer to Peer Protocol .....	69
3.4.5.1	Maintenance Peer to Peer Header .....	69
3.4.5.2	Maintenance Peer to Peer Message Data .....	70
3.5	Bite (Diagnostics Functionality) .....	70
3.5.1	Overview .....	70
3.5.1.1	Diagnostics Messages .....	70
3.5.1.2	DIAG_CMD (Diagnostics Command) Message .....	78
3.6	Power Control .....	83
3.6.1	Definitions .....	83
3.6.2	Power Control Overview .....	84
3.6.3	A350XWB ARINC 812 Power Control .....	85
3.6.4	Power Control Implementation .....	85
3.6.5	Centralized Power Control .....	85
3.6.5.1	Centralized Power Control Messages .....	86
3.6.5.2	GAIN State Transitions for Centralized Power Control .....	87
3.6.6	Fallback Power Control .....	98
3.6.6.1	Fallback Power Control Messages .....	99
3.7	Power Interrupt Resume Function .....	99

3.7.1	Pin Programming and Power Interrupt .....	100
3.7.1.1	Power Interrupt longer than 200 ms and shorter or equal than GAIN's Power Resume Time.....	103
3.7.1.2	Power Interrupt longer than GAIN's Power Resume Time .....	103
<b>4</b>	<b>State Transitions .....</b>	<b>105</b>

## TABLE OF FIGURES

Figure 3-1: Data Upload Transfer Sequence .....	59
Figure 3-2: Data Upload Service Transitions with Messages .....	60
Figure 3-3: Data Download Transfer Sequence.....	64
Figure 3-4: Data Download Service Transitions with Messages .....	65
Figure 3-5: Power Control Mode.....	85
Figure 4-1: State Transitions, General GAIN Behavior .....	105
Figure 4-2: Diagnostics State Transitions .....	105
Figure 4-3: Fallback Power Control State Transition.....	105
Figure 4-4: Secondary GAIN Fallback State Transitions.....	105
Figure 4-5: Primary GAIN Fallback PC State Transitions.....	105
Figure 4-6: Primary GAIN Fallback PC State Transitions.....	106
Figure 4-7: Central PC General State Transitions.....	106
Figure 4-8: Power Interrupt State Transitions .....	106
Figure 4-9: General MGCU Behavior.....	106

## TABLE OF TABLES

Table 1-1: General Abbreviations .....	6
Table 1-2: MGCU Abbreviations.....	7
Table 1-3: Abbreviations Electrical Galley Inserts.....	7
Table 1-4: CAN Message Abbreviations.....	8
Table 1-5: Data Format .....	9
Table 1-6: Data Format Example.....	9
Table 1-7: Bit Sign.....	10
Table 2-1: Message Identifiers .....	14
Table 2-2: Data Transfer Message Identifiers .....	14
Table 2-3: Device IDs.....	14
Table 2-4: Source IDs .....	15
Table 2-5: CAN Messages overview.....	15
Table 2-6: Block 1: GAIN Standard .....	17
Table 2-7: Block 2: GAIN Functionality .....	18
Table 2-8: Block3: GAIN Power Thresholds .....	19
Table 2-9: Block 4: GAIN Partial Power Capabilities.....	19
Table 2-10: Block 5: GAIN Data .....	22
Table 2-11: Block 6. Maintenance Data.....	22
Table 2-12: Block 7: Gain Catering Data .....	23
Table 2-13: Block 8: GAIN Flight Data.....	25
Table 2-14: Block 9: GAIN Timers .....	26
Table 2-15: Block 9: GAIN Timer Default Values.....	26
Table 2-16: Block 12: Counter Management .....	27
Table 2-17: Block 12: Counter Management Default Values .....	27
Table 2-18: Block 2: MGCU Functionality .....	28
Table 2-19: Block 6: MGCU Maintenance Data .....	29
Table 2-20: Block 8: Flight Data .....	31
Table 2-21: Block 10: MGCU Timer Data .....	31
Table 2-22: Block 10: MGCU Timer Default Values.....	31
Table 2-23: Block 12: Counter Management .....	32
Table 2-24: Block 12: Counter Management Default Values .....	33
Table 3-1: Transmission/Reception .....	35
Table 3-2: MGCU Counter Timer Values.....	36

Table 3-3: STA_MGCU Data Field Format .....	39
Table 3-4: STA_MGCU Signals .....	40
Table 3-5: STA_GAIN Data Field Format .....	44
Table 3-6: STA_GAIN components .....	45
Table 3-7: GAIN Counter Timer Values .....	47
Table 3-8: FLIGHT_INFO Data Field Format .....	50
Table 3-9: SES_MGCU Message Identifier .....	51
Table 3-10: SES_MGCU Signals .....	52
Table 3-11: SES_MGCU Message Format .....	52
Table 3-12: SES_GAIN Message Identifier .....	53
Table 3-13: SES_GAIN Signals .....	53
Table 3-14: SES_GAIN_Message Format .....	53
Table 3-15: Data Transfer Service Function Codes .....	58
Table 3-16: Data Transfer CAN Message Request Identifier .....	58
Table 3-17: Data Transfer CAN Message Response Identifier .....	59
Table 3-18: Data Transfer CAN Message Data Identifier .....	59
Table 3-19: Data Transfer Packet .....	59
Table 3-20: Data Upload Request Message .....	61
Table 3-21: Data Upload Response Message .....	62
Table 3-22: Data Upload Request Message #2 .....	62
Table 3-23: Data Upload Response Message #2 .....	64
Table 3-24: Data Upload Acknowledge Response #2 .....	64
Table 3-25: Data Download Request Message .....	65
Table 3-26: Data Download Response Message .....	66
Table 3-27: Data Download Request Message #2 .....	67
Table 3-28: Data Download Response Message #2 .....	69
Table 3-29: Data Download Acknowledge Response Message .....	69
Table 3-30: Maintenance Peer-to-Peer Message Header .....	70
Table 3-31: Maintenance Peer-to-Peer Message Data .....	70
Table 3-32: DIAG Message .....	71
Table 3-33: DIAG Message Failure Coding .....	73
Table 3-34: DIAG Message with Malfunction Bit Coding .....	75
Table 3-35: DIAG Message with Warning Coding .....	78
Table 3-36: DIAG_CMD Message Format .....	80
Table 3-37: Error Definition Matrix .....	83
Table 3-38: Power Control Definitions .....	84
Table 3-39: Power Control Messages .....	87
Table 3-40: GAIN_PT Message Signals .....	87
Table 3-41: GAIN Power Thresholds Message Format .....	89
Table 3-42: GAIN Power Thresholds Message Elements .....	90
Table 3-43: PBR Message Signals .....	91
Table 3-44: Power Budget Request Message Format .....	93
Table 3-45: PBM Message Signals .....	95
Table 3-46: Power Budget Maximum Message Format .....	96
Table 3-47: Power Budget Maximum Message Elements .....	98
Table 3-48: Fallback Power Control Messages .....	99
Table 3-49: Power Interrupt Resume Table /s .....	100
Table 3-50: Pin Programming Connector Definition .....	102

# 1 General

This document describes all CAN-Bus interfaces for the Galley Network Controller and the Galley Inserts in the A350 program.

Those interfaces are defined as the Galley System internal communication, between the Galley Network Controller and the Galley Inserts.

The interfaces for all CAN-Busses between Galley Network Controller and Electrical Galley Insert are derived from ARINC 812 Draft 2 Supplement 2.

Difference between NSD and ARINC 812 will be highlighted in yellow.

Note: The MGCU within this document complies with the GNC for A350 program.

## 1.1 Abbreviations

### 1.1.1 General

Abbreviation	Term
A350	Airbus A350 aircraft
ACK	Acknowledge
AMS	Aerospace Materials Specification
ARINC	Aeronautical Radio Incorporated
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
A/C	Aircraft
BIN	Binary
BITE	Build In Test Equipment
CAN	Controller Area Network
CCV	Controlling Cooling
CIDS	Cabin Intercommunication Data System
DC	Direct Current
DLC	Data Length Code
DOC	Data Object Code
DT	Data Transfer
FAL	Fault Applicability List
FID	Function code Identifier
GDB	Galley Data Bus
GND	Ground
ID	Identifier
LCC	Logical Communication Channel
LCL	Local bit
LH	Left Hand
LRU	Line Replaceable Unit
LSB	Least Significant Bit
MICBAC	Micro-System Bus Access Channel

Abbreviation	Term
MIL	Military
MS	Military Standard
MSB	Most Significant Bit
MGCU	Master Galley Control Unit
MS	Millisecond
N/A	Not Applicable
NAS	National Aerospace Standard
NM	Network Management
NSD	Network Supplier Document
NVM	Non Volatile Memory
PB	Power Budget
PC	Power Control
PDO	Process Data Object
PVT	Private bit
RCI	Redundancy Channel Identifier
RH	Right Hand
RSD	Reserved bit
SAE	Society of Automotive Engineers
SCS	Supplemental Cooling System
SDO	Service Data Object
SES	System Expanded Service
SID	Source ID
SMT	Service Message Type
STO	Storage Message
UTC	Universal Time Correlation
UTF-8	Unicode Transformation Format, 8 bit
VA	Volt Ampere
VDC	Volts Direct Current

**Table 1-1: General Abbreviations**

### 1.1.2 Galley Network Controller

Abbreviation	Term
MGCU	Master Galley Control Unit (with generic functionalities)

**Table 1-2: MGCU Abbreviations**

### 1.1.3 Electrical Galley Inserts

Abbreviation	Term
GAIN	Electrical Galley Insert

**Table 1-3: Abbreviations Electrical Galley Inserts**

### 1.1.4 CAN-Messages

Abbreviation	Term
STA_MGCU	MGCU_LifePulse
STA_GAIN	GAIN_LifePulse
DUS	Data_Upload_Service
DDS	Data_Download_Service
PBR	Power_Budget_Request
PBM	Power_Budget_Max
GAIN_PT	GAIN_Power_Threshold
DIAG_CMD	Diagnosis Command
DIAG_FAILURE	Diagnostic Response Failure
DIAG_MALFUNCTION	Diagnostic Response Malfunction
DIAG_WARNING	Diagnostic Response Warning
FLIGHT_INFO	Flight_Information
SES_MGCU	System_Expanded_Service_MGCU
SES_GAIN	System_Expanded_Service_GAIN
PHSM	Periodic_Health_Status_Message
DT_REQ	Data Transfer Message Request
DT_RES	Data Transfer Message Response
DT_DDL	Data Transfer Message Data Download

Abbreviation	Term
DT_DUL	Data Transfer Message Data Upload

**Table 1-4: CAN Message Abbreviations**

## 1.2 Terms

**VARIANT:** Is a specific model definition, e.g., modified design weight.

**SERIES:** Designates specific structure and system design characteristics within an A/C type, e.g.: A350-800, A350-900, A350-1000. Etc.

The use of "shall", "should", "must", "will" and "may" within this Specification shall observe the following rules:

- The word SHALL in the text denotes a mandatory requirement of this Specification. Departure from such a requirement is not permissible without formal agreement.
- The word SHOULD in the text denotes a recommendation or advice on implementing such a requirement of the document. Such recommendations or advice is expected to be followed unless good reasons are stated for not doing so.
- The word MUST in the text is used for legislative or regulatory requirements (e.g., Health and Safety) and shall be complied with. It is not used to express a requirement of this Specification
- The word WILL in the text denotes a provision or service or an intention in connection with a requirement of this Specification.
- The word MAY in the text denotes a permissible practice or action. It does not express a requirement of this Specification.
- The word "Equipment" is used instead of Galley Network Controller (MGCU) within this Specification.
- The word "ARINC812" is used for ARINC 812 Draft 2 Issue 2 Specification within this Specification.
- The word "Network" is used instead of Electrical Galley Insert System

## 1.3 Definitions

**FAIL-SAFE:** Provisions that maintain safety even when a failure occurs.

**GALLEY:** Any A/C structure specifically designed or modified to contain food or food preparation equipment, independently or by means of Galley Insert Equipment.

**GALLEY NETWORK CONTROLLER (MGCU):** Electrical equipment, used for communication between A/C side at A350 program and Electrical Galley Inserts to realized all in ARINC812 functions which is related to MGCU.

**ELECTRICAL GALLEY INSERT EQUIPMENT (GAIN):** Electrical equipment, used in conjunction with A/C food service, which is not an integral part of the galley and is removable from the galley without tools or with the use of simple tools (e.g., beverage maker, oven).

**GALLEY INSTALLATION:** That equipment/subsystem used in conjunction with A/C food service which is integral part of the galley (e.g., Galley Potable Waste System, Galley Waste Water System).

**INDUSTRY SPECIFICATION:** A specification that is accepted industry wide (e.g., SAE (AS, ARP, & AMS), military (MIL & MS), National Aerospace Standard (NAS)) and Aeronautical Radio Incorporated (ARINC).

**Network NODE:** A MGCU / a GAIN which is connected to Electrical Galley Systems.

## 1.4 Data Format

The format of the transmitted data is given in the following table:

Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	...	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
Byte	0								1								6								7								

**Table 1-5: Data Format**

The next table gives an example for values transmitted MSB first (big endian). This also holds for values that are streamed across the 8 bit boundary, like the 12 bit value contained in byte #6 and partly in byte #7.

Bit	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	...	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63			
Binary	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	...	1	1	1	0	1	0	1	0	0	1	0	1	0	1	1	0			
Value	10								1				Reserved				...								3749								Res.		6	
Byte	0								1								6								7											

**Table 1-6: Data Format Example**

## 1.5 Coding

### 1.5.1 Binary Unsigned

Binary coding: n bits,  $b_{n-1}, \dots, b_0$

MSB =  $b_{n-1}$

LSB =  $b_0$

$$value = \sum_{i=n-1}^0 2^i b_i$$

### 1.5.2 Binary Signed

Signed binary coded (2-complement). n bits,  $b_{n-1}, \dots, b_0$

MSB =  $b_{n-1}$

LSB =  $b_0$

$$value = -2^{n-1} b_{n-1} + \sum_{i=n-2}^0 2^i b_i$$

### 1.5.3 Example

n = 8

MSB $b_7$	$b_6$	$b_5$	$b_4$	$b_3$	$b_2$	$b_1$	LSB $b_0$	Value
0	0	0	0	0	0	0	1	1
1	1	1	1	1	1	1	1	-1
0	0	0	0	0	1	0	0	4

MSB b <sub>7</sub>	b <sub>6</sub>	b <sub>5</sub>	b <sub>4</sub>	b <sub>3</sub>	b <sub>2</sub>	b <sub>1</sub>	LSB b <sub>0</sub>	Value
1	1	1	1	1	1	0	0	-4
0	0	0	0	0	1	0	1	5
1	1	1	1	1	0	1	1	-5
0	1	1	1	1	1	1	1	127
1	0	0	0	0	0	0	1	-127
1	0	0	0	0	0	0	0	-128

Table 1-7: Bit Sign

## 1.6 Transmission Rules

### 1.6.1 Status Data

In a Status data Message every data-bit has one defined meaning. One or more of the following transmission principles should be used for every message.

- Timer

Cyclic transmission with a defined frequency

- On event

Event driven transmission when at least one bit of the message has changed. To prevent from permanent sending, the minimum mean time between two transmissions should be limited (inhibit time).

- On request

Transmission after receive of a corresponding message.

All SDO messages will be transmitted only when requested (e.g. MICBAC data shall be transmitted only when the unit is in shop-maintenance mode and the corresponding command has been received). Therefore no Inhibit time for SDO messages is necessary.

#### NSD350-V-25-36-103

The Global Inhibit time for all messages except data transfer messages shall be at least 200 ms and shall be observed for each message type separately.

#### NSD350-V-25-36-336

The Inhibit Time DT for all data transfer messages shall be at least 50 ms and shall be observed for each data transfer message separately

## 1.7 Transfer Rate

### NSD350-V-25-36-104

The transfer rate shall be 125 kbits/s.

## 1.8 Maximum Bus Load

### NSD350-V-25-36-105

The maximum busload for all non data-transfer messages shall be 80%.

Note:

The maximum message amount per second is 650 messages based on the following calculation:

Baud Rate = 125 kbit/s

CAN Frame Length = 154 bit / message (ISO 11898)

Max. Busload = Baud Rate ÷ CAN Frame Length

Max Busload = (125kbit × message) ÷ (s × 154 bit)

Max. Busload = 811 messages / s

80 % Busload = 650 messages / s

### NSD350-V-25-36-106

To be prepared for special conditions like data-download, shop-maintenance mode or malfunction of other devices, the maximum bus load of 100% shall be taken into account for design of input buffering and filtering functions.

## 1.9 Automatic Resets

### NSD350-V-25-36-107

In case of failures on the CAN-Bus, which lead to a "Bus Off" state (Transmitter Error Counter > 255) of the CAN-Controller, an automatic software-reset of the CAN-Controller shall be performed with a time delay after reset of 5 seconds. This means that the minimum meantime between each software-reset of one CAN-Controller shall be at least 5 seconds.

## 1.10 Periodic Health Status Message (PHSM\_GAIN / PHSM\_MGCU)

Comment: for details, please refer to §7.5.4 of the ARINC 825.

### NSD350-V-25-36-108

PHSM\_GAIN shall be send by each GAIN every 10 seconds.

### NSD350-V-25-36-829

PHSM\_MGCU shall be send by each MGCU every 10 seconds.

## 2 Electrical Galley Inserts

### 2.1 CAN-Bus Definition

Devices attached to the CAN-Bus

- MGCU
- GAIN
  - Beverage Maker
  - Convection Oven
  - Steam Oven
  - 3 Mode Freezer
  - Water Heater
  - Espresso Maker
  - Bun Warmer
  - Beverage Cup
  - Microwave
  - Multifunctional Unit
  - Trash Compactor
  - SCS - Chiller
  - Other NSD350 conform GAIN type

#### NSD350-V-25-36-110

With respect to all message definitions, any message element designated as “reserved” shall be set to the 0 (zero) value.

#### NSD350-V-25-36-111

With respect to all Configuration Data Block definitions, any block element designated as "reserved" shall be set to the 0 (zero) value.

## 2.2 Message Numbering

#### NSD350-V-25-36-112

Every Message shall have a unique identifier (29 Bits) which is the message DeviceID and the message code. This identifier shall be as specified within the following table, except data transfer messages:

Bit Number	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5 <sub>3</sub>	4	3	2	1	0	
ID	LCC		Source FID								RSD	LCL	PVT	DOC										RCI						
														Message Code										Device ID						
FLIGHT_INFO	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	1	1	1	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
GAIN_PT	0	1	0	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	0	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
PBR	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
PBM	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
DIAG_CMD	0	1	0	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
DIAG_FAILURE	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
DIAG_MALFUNCTION	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	1	1	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
DIAG_WARNING	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	1	1	0	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
STA_MGCU	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
STA_GAIN	0	1	0	1	1	1	1	0	1	1	0	1	0	0	0	0	0	1	0	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
SES_MGCU	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
SES_GAIN	0	1	1	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	1	0	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0

PHSM_MGCU	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0
PHSM_GAIN	1	1	0	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	0	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	0	0

**Table 2-1: Message Identifiers**

**NSD350-V-25-36-115**

Data Transfer messages shall have a unique identifier (29 Bits) which is the message SID, SMT and PVT. This identifier shall be as specified within the following table and is applicable for Data Transfer between MGCU and GAIN:

Bit Number	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5 <sub>3</sub>	4	3	2	1	0
ID	LCC			Client FID						SMT	LCL	PVT	Service FID						SID				RCI						
DT_REQ	1	0	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	**	**
DT_RES	1	0	0	1	1	1	1	0	1	1	0	1	0	1	1	1	1	0	1	1	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	**	**
DT_DDL	1	0	0	1	1	1	1	0	1	1	0	1	1	1	1	1	1	0	1	1	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	**	**
DT_DUL	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	Z <sub>6</sub>	Z <sub>5</sub>	Z <sub>4</sub>	Z <sub>3</sub>	Z <sub>2</sub>	Z <sub>1</sub>	Z <sub>0</sub>	**	**

**Table 2-2: Data Transfer Message Identifiers**

**NSD350-V-25-36-118**

Every CAN Node shall have a Device Identifier which shall be used as specified within the following table, except data transfer messages:

Z (Z <sub>0</sub> = LSB, Z <sub>6</sub> = MSB) (decimal, binary coded)	Device Identifier
1-127	Device number defined by pin programming
0	Undefined Device ID used in conjunction with bad pin programming (Also known as Default Device ID)

**Table 2-3: Device IDs**

**NSD350-V-25-36-338**

Every data transfer CAN Node shall have a Source Identifier which shall be used as specified within the following table:

Z (Z <sub>0</sub> = LSB, Z <sub>6</sub> = MSB) (decimal, binary coded)	Source Identifier
1-127	Source ID defined by pin programming
0	Multicast Identifier (reference ARINC 825)

**Table 2-4: Source IDs**

**NSD350-V-25-36-348**

The Multicast Identifier (reference ARINC 825) shall be used only from MGCU.

With respect of this document the following table gives an overview about which CAN messages will be send and which will be processed by the Equipment connected to the CAN bus:

Message Name	Send by	Processed by
FLIGHT_INFO	MGCU	GAIN
GAIN_PT	GAIN	MGCU
PBR	GAIN	MGCU
PBM	MGCU	GAIN
DIAG_CMD	MGCU	GAIN
DIAG_FAILURE	GAIN	MGCU
DIAG_MALFUNCTION	GAIN	MGCU
DIAG_WARNING	GAIN	MGCU
STA_MGCU	MGCU	GAIN
STA_GAIN	GAIN	MGCU
SES_MGCU	MGCU	GAIN
SES_GAIN	GAIN	MGCU
PHSM	MGCU & GAIN	N/A
Data Transfer Messages	MGCU & GAIN	MGCU & GAIN

**Table 2-5: CAN Messages overview**

## 2.3 GAIN Configuration Datablock

**NSD350-V-25-36-121**

Each GAIN Configuration Data Block Value shall be verifiable externally, and shall be verified against the contents of this document.

Comment: The verification method is up to the GAIN supplier

**NSD350-V-25-36-122**

Only GAIN data block no. 8 shall be modifiable by the MGCU using the data transfer mechanism.

**NSD350-V-25-36-252**

Each configuration block shall be contained in non-volatile memory.

**NSD350-V-25-36-253**

Each configuration data item contained in each configuration data block shall be verified as valid prior to use. Valid is defined as data within a stated range.

**NSD350-V-25-36-254**

The MGCU shall be allowed to read any configuration data block from the GAIN using the Data Transfer Data Download Service (DDS) mechanism defined in section 3.4

**NSD350-V-25-36-255**

If a configuration data item is invalid (as defined above), the default value for that item shall be used. Additionally, the default value shall be written into the configuration data block. This guarantees that NVM Configuration Data is always valid prior to use.

**2.3.1 Block 1 GAIN Standard****NSD350-V-25-36-260**

For Block number 1 the Equipment shall use the values from table below.

<i>Block 1: Gain Standard</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
1	0	0	Device Standard	8 Bit	Binary	0-255
1	1	0	Standard Version Char #0	8 Bit	UTF-8	0-255
1	1	1	Standard Version Char #1	8 Bit	UTF-8	0-255
1	1	2	Standard Version Char #2	8 Bit	UTF-8	0-255
1	1	3	Standard Version Char #3	8 Bit	UTF-8	0-255
1	1	4	Standard Version Char #4	8 Bit	UTF-8	0-255
1	1	5	Standard Version Char #5	8 Bit	UTF-8	0-255

**Table 2-6: Block 1: GAIN Standard**

**NSD350-V-25-36-152**

The Device Standard shall be set to 1.

**NSD350-V-25-36-153**

The Standard Version Characters 0 to 5 shall be set to "NSDIXX" (e.g. NSD-Issue 3 set to "NSDI03").

**2.3.2 Block 2 GAIN Functionality****NSD350-V-25-36-261**

For Block number 2 the Equipment shall use the values from table below.

<i>Block 2: GAIN Functionality</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
2	0	0	GAIN implemented functionality	8 Bit	Binary	0-255

**Table 2-7: Block 2: GAIN Functionality****NSD350-V-25-36-156**

A Bit set to 1 within Block No. 2 Parameter No. 0 shall reflect the following implemented functionalities within a GAIN:

- Bit:0: GAIN Remote Operation Functionality
- Bit:1: Centralized Power Control Functionality
- Bit:2: Decentralized Power Control Functionality
- Bit:3: Diagnosis Functionality
- Bit:4: Fallback Power Control Mode Functionality
- Bit 5: Storage Mode Functionality
- Bit 6: Data Transfer
- Bit 7: Reserved

**2.3.3 Block 3 GAIN Power Thresholds****NSD350-V-25-36-262**

For Block number 3 the Equipment shall use the values from table below.

<i>Block 3: GAIN Power Thresholds</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
3	0	0	Maximum Power Budget	8 Bit	Binary [VA*50]	50-12750 [VA]
3	1	0	Fallback Power Threshold	8 Bit	Binary [VA*50]	50-12750 [VA]
3	2	0	Minimum Power Budget	8 Bit	Binary [VA*50]	50-12750 [VA]
3	3	0	Standby Power Threshold	8 Bit	Binary [VA*5]	5-1275 [VA]

**Table 2-8: Block3: GAIN Power Thresholds**

### 2.3.4 Block 4 GAIN Partial Power Capabilities

#### NSD350-V-25-36-263

For Block number 4 the Equipment shall use the values from table below.

<i>Block 4: Partial Power Capabilities</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
4	0	0	# of power budget steps	8 Bit	Binary	0-14
4	1	0	Power Budget Step #1	8 Bit	Binary [VA*50]	50-12750[VA]
4	2	0	Power Budget Step #2	8 Bit	Binary [VA*50]	50-12750[VA]
4	3	0	Power Budget Step #3	8 Bit	Binary [VA*50]	50-12750[VA]
4	4	0	Power Budget Step #4	8 Bit	Binary [VA*50]	50-12750[VA]
4	5	0	Power Budget Step #5	8 Bit	Binary [VA*50]	50-12750[VA]
4	6	0	Power Budget Step #6	8 Bit	Binary [VA*50]	50-12750[VA]
4	7	0	Power Budget Step #7	8 Bit	Binary [VA*50]	50-12750[VA]
4	8	0	Power Budget Step #8	8 Bit	Binary [VA*50]	50-12750[VA]
4	9	0	Power Budget Step #9	8 Bit	Binary [VA*50]	50-12750[VA]
4	10	0	Power Budget Step #10	8 Bit	Binary [VA*50]	50-12750[VA]
4	11	0	Power Budget Step #11	8 Bit	Binary [VA*50]	50-12750[VA]
4	12	0	Power Budget Step #12	8 Bit	Binary [VA*50]	50-12750[VA]
4	13	0	Power Budget Step #13	8 Bit	Binary [VA*50]	50-12750[VA]
4	14	0	Power Budget Step #14	8 Bit	Binary [VA*50]	50-12750[VA]

**Table 2-9: Block 4: GAIN Partial Power Capabilities**

### 2.3.5 Block 5 GAIN Data

#### NSD350-V-25-36-264

For Block number 5 the Equipment shall use the values from table below.

<i>Block 5: GAIN Data</i>						
<i>Block No.</i>	<i>Param No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
5	0	0	Fallback Type	8 Bit	Binary	0-1
5	1	0	Feeder #	8 Bit	Binary	0-31
5	2	0	Device #	8 Bit	Binary	0-127

5	3	0	Device Class	8 Bit	Binary	0-255
5	4	0	Device Group	8 Bit	Binary	0-255
5	5	0	Part Number Char #0	8 Bit	UTF-8	0-255
5	5	1	Part Number Char #1	8 Bit	UTF-8	0-255
5	5	2	Part Number Char #2	8 Bit	UTF-8	0-255
5	5	3	Part Number Char #3	8 Bit	UTF-8	0-255
5	5	4	Part Number Char #4	8 Bit	UTF-8	0-255
5	5	5	Part Number Char #5	8 Bit	UTF-8	0-255
5	5	6	Part Number Char #6	8 Bit	UTF-8	0-255
5	5	7	Part Number Char #7	8 Bit	UTF-8	0-255
5	5	8	Part Number Char #8	8 Bit	UTF-8	0-255
5	5	9	Part Number Char #9	8 Bit	UTF-8	0-255
5	5	10	Part Number Char #10	8 Bit	UTF-8	0-255
5	5	11	Part Number Char #11	8 Bit	UTF-8	0-255
5	5	12	Part Number Char #12	8 Bit	UTF-8	0-255
5	5	13	Part Number Char #13	8 Bit	UTF-8	0-255
5	5	14	Part Number Char #14	8 Bit	UTF-8	0-255
5	5	15	Part Number Amendment	8 Bit	UTF-8	0-255
5	6	0	Serial Number #0	8 Bit	UTF-8	0-255
5	6	1	Serial Number #1	8 Bit	UTF-8	0-255
5	6	2	Serial Number #2	8 Bit	UTF-8	0-255
5	6	3	Serial Number #3	8 Bit	UTF-8	0-255
5	6	4	Serial Number #4	8 Bit	UTF-8	0-255
5	6	5	Serial Number #5	8 Bit	UTF-8	0-255
5	6	6	Serial Number #6	8 Bit	UTF-8	0-255
5	6	7	Serial Number #7	8 Bit	UTF-8	0-255
5	6	8	Serial Number #8	8 Bit	UTF-8	0-255
5	6	9	Serial Number #9	8 Bit	UTF-8	0-255
5	6	10	Serial Number #10	8 Bit	UTF-8	0-255
5	6	11	Serial Number #11	8 Bit	UTF-8	0-255
5	7	0	Hardware Version Char #0	8 Bit	UTF-8	0-255
5	7	1	Hardware Version Char #1	8 Bit	UTF-8	0-255

5	7	2	Hardware Version Char #2	8 Bit	UTF-8	0-255
5	7	3	Hardware Version Char #3	8 Bit	UTF-8	0-255
5	7	4	Hardware Version Char #4	8 Bit	UTF-8	0-255
5	7	5	Hardware Version Char #5	8 Bit	UTF-8	0-255
5	7	6	Hardware Version Char #6	8 Bit	UTF-8	0-255
5	8	0	Software Version Char #0	8 Bit	UTF-8	0-255
5	8	1	Software Version Char #1	8 Bit	UTF-8	0-255
5	8	2	Software Version Char #2	8 Bit	UTF-8	0-255
5	8	3	Software Version Char #3	8 Bit	UTF-8	0-255
5	8	4	Software Version Char #4	8 Bit	UTF-8	0-255
5	8	5	Software Version Char #5	8 Bit	UTF-8	0-255
5	8	6	Software Version Char #6	8 Bit	UTF-8	0-255
5	9	0	# of clusters	8 Bit	BIN	1-255

Table 2-10: Block 5: GAIN Data

### 2.3.6 Block 6 GAIN Maintenance Data

#### NSD350-V-25-36-269

For Block number 6 the Equipment shall use the values from table below.

<i>Block 6: Maintenance Data</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
6	0	0	Last Maint. Check Year	8 Bit	Binary	0-99
6	0	1	Last Maint. Check Month	8 Bit	Binary	1-12
6	0	2	Last Maint. Check Day	8 Bit	Binary	1-31
6	1	0	Next Maint. Check Year	8 Bit	Binary	0-99
6	1	1	Next Maint. Check Month	8 Bit	Binary	1-12
6	1	2	Next Maint. Check Day	8 Bit	Binary	1-31
6	2	0	Operation cycles	16 Bit	Binary [count]	1-65534
6	2	1	Power On Time	16 Bit	Binary [min]	1-65534

Table 2-11: Block 6. Maintenance Data

### 2.3.7 Block 7 GAIN Catering Data

#### NSD350-V-25-36-267

For Block number 7 the Equipment shall use the values from table below.

<i>Block 7: Catering Data</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
7	0	0	Overall number of catering programs	8 Bit	Binary	1-127
7	# of program	0	Program Number 1	8 Bit	Binary	1-127
7	# of program	1	Time	16 Bit	Binary[s]	0-65535
7	# of program	2	Aimed Physical Unit	8 Bit	Binary	
7	# of program	3	Physical Property #1	8 Bit	Binary	
7	# of program	4	Physical Property #2	8 Bit	Binary	
7	# of program	0	Program Number 2	8 Bit	Binary	1-127
7	# of program	1	Time	16 Bit	Binary[s]	0-65535
7	# of program	2	Aimed Physical Unit	8 Bit	Binary	
7	# of program	3	Physical Property #1	8 Bit	Binary	
7	# of program	4	Physical Property #2	8 Bit	Binary	
7	# of program	0	Program Number 3	8 Bit	Binary	1-127
7	# of program	1	Time	16 Bit	Binary[s]	0-65535
7	# of program	2	Aimed Physical Unit	8 Bit	Binary	
7	# of program	3	Physical Property #1	8 Bit	Binary	
7	# of program	4	Physical Property #2	8 Bit	Binary	
...	...	...	...	...	...	...

**Table 2-12: Block 7: Gain Catering Data**

Note: The usage of this data block no.7 can be used for vendor tools.

### 2.3.8 Block 8 GAIN Flight Data

#### NSD350-V-25-36-171

Flight data shall be updated by a data transfer mechanism sent by the MGCU.

#### NSD350-V-25-36-268

For Block number 8 the Equipment shall use the values from table below.

<i>Block 8: Flight Data</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
8	0	0	City Pair From Char #0	8 Bit	UTF-8	0-255
8	0	1	City Pair From Char #1	8 Bit	UTF-8	0-255
8	0	2	City Pair From Char #2	8 Bit	UTF-8	0-255
8	0	3	City Pair From Char #3	8 Bit	UTF-8	0-255
8	1	0	City Pair To Char #0	8 Bit	UTF-8	0-255
8	1	1	City Pair To Char #1	8 Bit	UTF-8	0-255
8	1	2	City Pair To Char #2	8 Bit	UTF-8	0-255
8	1	3	City Pair To Char #3	8 Bit	UTF-8	0-255
8	2	0	Flight Number #0	8 Bit	UTF-8	0-255
8	2	1	Flight Number #1	8 Bit	UTF-8	0-255
8	2	2	Flight Number #2	8 Bit	UTF-8	0-255
8	2	3	Flight Number #3	8 Bit	UTF-8	0-255
8	2	4	Flight Number #4	8 Bit	UTF-8	0-255
8	2	5	Flight Number #5	8 Bit	UTF-8	0-255
8	2	6	Flight Number #6	8 Bit	UTF-8	0-255
8	2	7	Flight Number #7	8 Bit	UTF-8	0-255
8	2	8	Flight Number #8	8 Bit	UTF-8	0-255
8	2	9	Flight Number #9	8 Bit	UTF-8	0-255
8	3	0	A/C ID Char #0	8 Bit	UTF-8	0-255
8	3	1	A/C ID Char #1	8 Bit	UTF-8	0-255
8	3	2	A/C ID Char #2	8 Bit	UTF-8	0-255
8	3	3	A/C ID Char #3	8 Bit	UTF-8	0-255
8	3	4	A/C ID Char #4	8 Bit	UTF-8	0-255
8	3	5	A/C ID Char #5	8 Bit	UTF-8	0-255
8	3	6	A/C ID Char #6	8 Bit	UTF-8	0-255

**Table 2-13: Block 8: GAIN Flight Data****2.3.9 Block 9 GAIN Timer****NSD350-V-25-36-270**

For Block number 9 the Equipment shall use the values from table below.

<i>Block 9: GAIN Timer</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
9	0	0	Global Inhibit Timer	16Bit	Binary[ms]	1-65535
9	0	1	Inhibit Timer DT	16Bit	Binary[ms]	1-65535
9	1	0	Sequence Timeout Timer	16 Bit	Binary[ms]	1-65535
9	2	0	N/A	16 Bit	Binary[ms]	1-65535
9	3	0	N/A	16 Bit	Binary[ms]	1-65535
9	4	0	N/A	16 Bit	Binary[ms]	1-65535
9	5	0	N/A	16 Bit	Binary[ms]	1-65535
9	6	0	Timer STA_GAIN	16 Bit	Binary[ms]	1-65535
9	6	1	Timeout Timer STA_GAIN	16 Bit	Binary[ms]	1-65535
9	7	0	Timer STA_MGCU	16 Bit	Binary[ms]	1-65535
9	7	1	Timeout Timer STA_MGCU	16 Bit	Binary[ms]	1-65535
9	8	0	Timer SES_MGCU	16 Bit	Binary[ms]	1-65535
9	8	1	Timer SES_GAIN	16 Bit	Binary[ms]	1-65535
9	8	2	Timeout Timer SES	16 Bit	Binary[ms]	1-65535

**Table 2-14: Block 9: GAIN Timers****2.3.9.1 GAIN Timer Default Values****NSD350-V-25-36-182**

Following table specifies the default timer values in milli seconds (ms):

<i>Parameter</i>	<i>Default Value</i>
Global Inhibit Timer	200
Inhibit Timer DT	50
Sequence Timeout Timer	5000
Timer STA_GAIN	1000
Timeout Timer STA_GAIN	1200
Timer STA_MGCU	1000
Timeout Timer STA_MGCU	1200
Timer SES_GAIN	1000

<i>Parameter</i>	<i>Default Value</i>
Timer SES_MGCU	1000
Timeout Timer SES	1200

**Table 2-15: Block 9: GAIN Timer Default Values****2.3.10 Block 10**

N/A

**2.3.11 Block 11**

N/A

**2.3.12 Block 12 Counter Management****NSD350-V-25-36-271**

For Block number 12 the Equipment shall use the values from table below.

<i>Block 12: Counter Management</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
12	0	0	MGCU counter delta inc	8 Bit	Binary	1-255
12	0	1	MGCU counter delta dec	8 Bit	Binary	1-255
12	0	2	MGCU counter threshold	8 Bit	Binary	1-255
12	1	0	GAIN counter delta inc	8 Bit	Binary	1-255
12	1	1	GAIN counter delta dec	8 Bit	Binary	1-255
12	1	2	GAIN counter threshold	8 Bit	Binary	1-255

**Table 2-16: Block 12: Counter Management****2.3.12.1 Block 12 Counter Management Default Values****NSD350-V-25-36-272**

Following table specifies the Counter Management Default Values:

<i>Parameter</i>	<i>Default Value</i>
MGCU counter delta inc	1
MGCU counter delta dec	1
MGCU counter threshold	3
GAIN counter delta inc	1
GAIN counter delta dec	1
GAIN counter threshold	3

Table 2-17: Block 12: Counter Management Default Values

## 2.4 MGCU Configuration Datablock

### 2.4.1 Block 1

N/A

### 2.4.2 Block 2 MGCU Functionality

#### NSD350-V-25-36-273

For Block number 2 the MGCU shall use the values from table below.

<i>Block 2: MGCU Functionality</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
2	0	0	MGCU supported functionality	8 Bit	Binary	

Table 2-18: Block 2: MGCU Functionality

#### NSD350-V-25-36-195

A Bit set to 1 within Block No. 2 Parameter No. 0 shall reflect the following implemented functionalities within an MGCU:

- Bit:0: MGCU Remote Operation Functionality
- Bit:1: Centralized Power Control Functionality
- Bit:2: Reserved
- Bit:3: Diagnosis Functionality
- Bit:4: Reserved
- Bit 5: Reserved
- Bit 6: Data Transfer
- Bit 7: Reserved

**NSD350-V-25-36-196**

Corresponding bits of not implemented functionality and reserved bits shall be set to 0.

**2.4.3 Block 3**

N/A

**2.4.4 Block 4**

N/A

**2.4.5 Block 5**

N/A

**2.4.6 Block 6 MGCU Maintenance Data****NSD350-V-25-36-274**

For Block number 6 the MGCU shall use the values from table below.

<i>Block 6: Maintenance Data</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
6	0	0	Last Maint. Check Year	8 Bit	Binary	0-99
6	0	1	Last Maint. Check Month	8 Bit	Binary	1-12
6	0	2	Last Maint. Check Day	8 Bit	Binary	1-31
6	1	0	Next Maint. Check Year	8 Bit	Binary	0-99
6	1	1	Next Maint. Check Month	8 Bit	Binary	1-12
6	1	2	Next Maint. Check Day	8 Bit	Binary	1-31
6	2	0	Operation cycles	16 Bit	Binary	1-65534
6	2	1	Power On Time	16 Bit	Binary	1-65534

**Table 2-19: Block 6: MGCU Maintenance Data**

**2.4.7 Block 7**

N/A

## 2.4.8 Block 8 Flight Data

### NSD350-V-25-36-275

For Block number 8 the MGCU shall use the values from table below.

<i>Block 8: Flight Data</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Param No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
8	0	0	City Pair From Char #0	8 Bit	UTF-8	
8	0	1	City Pair From Char #1	8 Bit	UTF-8	
8	0	2	City Pair From Char #2	8 Bit	UTF-8	
8	0	3	City Pair From Char #3	8 Bit	UTF-8	
8	1	0	City Pair To Char #0	8 Bit	UTF-8	
8	1	1	City Pair To Char #1	8 Bit	UTF-8	
8	1	2	City Pair To Char #2	8 Bit	UTF-8	
8	1	3	City Pair To Char #3	8 Bit	UTF-8	
8	2	0	Flight Number #0	8 Bit	UTF-8	
8	2	1	Flight Number #1	8 Bit	UTF-8	
8	2	2	Flight Number #2	8 Bit	UTF-8	
8	2	3	Flight Number #3	8 Bit	UTF-8	
8	2	4	Flight Number #4	8 Bit	UTF-8	
8	2	5	Flight Number #5	8 Bit	UTF-8	
8	2	6	Flight Number #6	8 Bit	UTF-8	
8	2	7	Flight Number #7	8 Bit	UTF-8	
8	2	8	Flight Number #8	8 Bit	UTF-8	
8	2	9	Flight Number #9	8 Bit	UTF-8	
8	3	0	A/C ID Char #0	8 Bit	UTF-8	
8	3	1	A/C ID Char #1	8 Bit	UTF-8	
8	3	2	A/C ID Char #2	8 Bit	UTF-8	
8	3	3	A/C ID Char #3	8 Bit	UTF-8	
8	3	4	A/C ID Char #4	8 Bit	UTF-8	
8	3	5	A/C ID Char #5	8 Bit	UTF-8	
8	3	6	A/C ID Char #6	8 Bit	UTF-8	

**Table 2-20: Block 8: Flight Data**

## 2.4.9 Block 9

N/A

## 2.4.10 Block 10 MGCU Timer

### NSD350-V-25-36-276

For Block number 10 the MGCU shall use the values from table below.

<i>Block 10: MGCU Timer</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
10	0	0	Global Inhibit Timer	16 Bit	Binary[ms]	1-65535
10	0	1	Inhibit Timer DT	16 Bit	Binary[ms]	1-65535
10	1	0	Sequence Timeout Timer	16 Bit	Binary[ms]	1-65535
10	2	0	N/A	16 Bit	Binary[ms]	1-65535
10	3	0	N/A	16 Bit	Binary[ms]	1-65535
10	4	0	Timer STA_MGCU	16 Bit	Binary[ms]	1-65535
10	4	1	N/A	16 Bit	Binary[ms]	1-65535
10	5	0	Timer STA_GAIN	16 Bit	Binary[ms]	1-65535
10	5	1	Timeout Timer STA_GAIN	16 Bit	Binary[ms]	1-65535
10	10	0	Timer SES_MGCU	16 Bit	Binary[ms]	1-65535
10	10	1	Timer SES_GAIN	16 Bit	Binary[ms]	1-65535
10	10	2	Timeout Timer SES	16 Bit	Binary[ms]	1-65535

**Table 2-21: Block 10: MGCU Timer Data**

### 2.4.10.1 Block 10 MGCU Timer Default Values

#### NSD350-V-25-36-279

The following table specifies the default timer values in milli seconds (ms):

<i>Parameter</i>	<i>Default Value</i>
Global Inhibit Timer	200
Inhibit Timer DT	50
Sequence Timeout Timer	5000
Timer STA_MGCU	1000
Timer STA_GAIN	1000
Timeout Timer STA_GAIN	1200
Timer SES_MGCU	1000
Timer SES_GAIN	1000
Timeout Timer SES	N/A

**Table 2-22: Block 10: MGCU Timer Default Values**

**2.4.11 Block 11**

N/A

**2.4.12 Block 12 Counter Management****NSD350-V-25-36-277**

For Block number 12 the MGCU shall use the values from table below.

<i>Block 12: Counter Management</i>						
<i>Block No.</i>	<i>Parameter No.</i>	<i>Sub-Parameter No.</i>	<i>Data</i>	<i>Designation</i>		
				<i># of BIT</i>	<i>Data Format</i>	<i>Range</i>
12	0	0	MGCU counter delta inc	8 Bit	Binary	1-255
12	0	1	MGCU counter delta dec	8 Bit	Binary	1-255
12	0	2	MGCU counter threshold	8 Bit	Binary	1-255
12	1	0	GAIN counter delta inc	8 Bit	Binary	1-255
12	1	1	GAIN counter delta dec	8 Bit	Binary	1-255
12	1	2	GAIN counter threshold	8 Bit	Binary	1-255

**Table 2-23: Block 12: Counter Management****2.4.12.1 Block 12 Counter Management Default Value****NSD350-V-25-36-278**

Following table specifies the Counter Management Default Values:

<i>Parameter</i>	<i>Default Value</i>
MGCU counter delta inc	1
MGCU counter delta dec	1
MGCU counter threshold	3
GAIN counter delta inc	1
GAIN counter delta dec	1
GAIN counter threshold	3

**Table 2-24: Block 12: Counter Management Default Values**

## **3 Galley Network Functions**

### **3.1 General**

The Galley Network is a system which includes 2 types of devices. These devices are the Galley Network Controller and the Electrical Galley Inserts. The communication between both devices is realized via CAN-Bus. In one network are a number of GAINs connected to 1 MGCU.

#### **NSD350-V-25-36-814**

All CAN Nodes shall only process to CAN messages if the Device ID portion of the 29-bit identifier is identical to the Device ID stored in the NVM (as read from the Pin Programming discretes). If the Device ID's do not match, the CAN message shall be rejected.

### **3.2 System Configuration Data**

#### **NSD350-V-25-36-257**

The MGCU shall be able to read or write the system configuration data block no. 8 of any GAIN connected to the Galley Network at any time, except the MGCU is in the "Error" state.

#### **NSD350-V-25-36-258**

The MGCU shall be able to read the configuration data blocks of every connected GAIN at any time except in case that the GAIN is in an 'Error' state.

Comment: This includes the "Initialization" state, except that no CAN communication is allowed to occur in this state.

#### **NSD350-V-25-36-259**

Every Node within the Electrical Galley Network shall use the default timer values specified in block no. 9 (GAIN) and block no. 10 (MGCU).

## **3.3 Network Monitoring**

### **3.3.1 Overview**

For an event driven architecture, using asynchronous messages, a life pulse signaling mechanism is needed to prevent an undetected loss of a component. Continuous monitoring of the data bus will determine if every device connected to the bus is still operating and able to communicate.

For every device connected to the galley data bus, STA (Status) messages will be cyclically broadcast to ensure that every device connected to the bus is still operating. MGCUs will cyclically broadcast the periodic status message STA\_MGCU, and GAINs will cyclically broadcast the periodic status message STA\_GAIN.

A "node" is defined as a CAN bus network device.

### 3.3.2 Message List

#### 3.3.2.1 Transmission/Reception

<i>Message Name</i>	<i>Device</i>	
	<i>Send</i>	<i>Receive</i>
STA_MGCU	MGCU	MGCU & GAIN
STA_GAIN	All GAINs	MGCU & GAIN
FLIGHT_INFO	MGCU	GAIN

**Table 3-1: Transmission/Reception**

#### 3.3.2.2 MGCU Life Pulse Status STA\_MGCU

##### NSD350-V-25-36-363

STA\_MGCU shall be periodically sent every TIMER\_STA\_MGCU milliseconds or on event unless the MGCU state is set to "Error".

##### NSD350-V-25-36-364

STA\_MGCU shall be sent on event in case of loss of centralized power control on a specific feeder with signal STA\_MGCU\_Power\_Info\_Feeder set to the respective feeder ID and Central\_Power\_Valid\_On\_Feeder set to 0 unless the MGCU state is set to "Error"

##### NSD350-V-25-36-365

STA\_MGCU shall be sent on event in case of availability of centralized power control on a specific feeder with signal STA\_MGCU\_Power\_Info\_Feeder set to the respective Feeder ID and Central\_Power\_Valid\_On\_Feeder set to 1 unless the MGCU state is set to "Error"

##### NSD350-V-25-36-366

If a GAIN is in Centralized Power Control Mode, and STA\_MGCU is received with signal Central\_Power\_Valid\_On\_Feeder set to 0, and GAIN is connected to the feeder identified by signal STA\_MGCU\_Power\_Info\_Feeder, the GAIN shall switch to Fallback Mode.

##### NSD350-V-25-36-367

If a GAIN is in Fallback Mode and a MGCU is considered "present" and STA\_MGCU is received with signal Central\_Power\_Valid\_On\_Feeder set to 1, and GAIN is connected to the feeder identified by signal STA\_MGCU\_Power\_Info\_Feeder, the GAIN shall switch to Centralized Power Control Mode.

#### 3.3.2.2.1 Detection of MGCU Presence/Absence

MGCU Communication Counter and Timer Values (Stored in NVM) in Configuration Data Block 10 for MGCU Timer Default Values:

<i>Item</i>	<i>Units</i>	<i>Definition</i>
MGCU_COUNTER_DELTA_INC	Integer	The value that will be added to an MGCU timeout counter.

		Default: 1
MGCU_COUNTER_DELTA_DEC	Integer	The value that will be subtracted from an MGCU timeout counter. Default: 1
MGCU_COUNTER_THRESHOLD	Integer	The threshold limit by which a MGCU timeout counter will be compared. Default: 3
TIMER_STA_MGCU	Integer	The periodic rate at which an MGCU sends its STA_MGCU life guarding message. Default: 1000 ms
TIMER_STA_TIMEOUT_MGCU	Integer	The time after which an MGCU timeout is noted. Default: 1200 ms

**Table 3-2: MGCU Counter Timer Values**

$\text{MGCU connection timeout time} = \text{MGCU\_COUNTER\_DELTA\_INC} * \text{MGCU\_COUNTER\_THRESHOLD} * \text{TIMER\_STA\_TIMEOUT\_MGCU}$   
 $\text{MGCU connection established time} = \text{MGCU\_COUNTER\_DELTA\_DEC} * \text{MGCU\_COUNTER\_THRESHOLD} * \text{TIMER\_STA\_TIMEOUT\_MGCU}$

**NSD350-V-25-36-376**

If STA\_MGCU message is not received within MGCU connection timeout time the MGCU shall be considered as "absent" from the network.

**NSD350-V-25-36-377**

If the quantity of MGCU\_COUNTER\_THRESHOLD STA\_MGCU messages are received within MGCU connection established time the MGCU shall be considered "present" on the network.

**NSD350-V-25-36-378**

During the time period when the MGCU network status is not confirmed as present or absent, the GAIN shall not start a catering cycle until the MGCU network status is confirmed.

Comment: Immediately following the GAIN "Initialization" state, the MGCU network status will not be confirmed until the MGCU connection timeout or connection established times have occurred.

**3.3.2.3 Data Field Format****NSD350-V-25-36-382**

STA\_MGCU message signals shall be used as specified within the table below:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	STA_MGCU_State MSB	Bits: 4 Coding: BIN Units: - Resolution: 1

	1	STA_MGCU_State	Range: 0: Reserved 1: Reserved 2: Operational 3: Maintenance 4: Error 5- 15: Reserved
	2	STA_MGCU_State	
	3	STA_MGCU_State LSB	
	4	STA_MGCU_Disinfection_Mode	Potable water supply disinfection state: 0: no ongoing disinfection 1: ongoing disinfection
	5	Reserved	0
	6	Reserved	0
	7	Reserved	0
1	8	STA_MGCU_Impl_Functionalities #0	GAIN Remote Operation 0: Not implemented 1: Implemented
	9	STA_MGCU_Impl_Functionalities #1	Centralized Power Control 0: Not implemented 1: Implemented
	10	STA_MGCU_Impl_Functionalities #2	Reserved
	11	STA_MGCU_Impl_Functionalities #3	Diagnostics 0: Not implemented 1: Implemented
	12	STA_MGCU_Impl_Functionalities #4	Reserved
	13	STA_MGCU_Impl_Functionalities #5	Reserved
	14	STA_MGCU_Impl_Functionalities #6	Data Transfer 0: Not implemented 1: Implemented
	15	STA_MGCU_Impl_Functionalities #7	Reserved
2	16	Reserved	0
	17	Reserved	0
	18	Reserved	0
	19	Reserved	0
	20	Reserved	0
	21	Reserved	0
	22	Reserved	0
	23	Reserved	0
3	24	STA_MGCU_Power_Info_Feeder MSB	Feeder ID, denotes the feeder signal Central_Power_valid_On_Feeder applies to. Bits: 5 Coding: BIN Units: - Resolution: 1 0- 31: Feeder ID
	25	STA_MGCU_Power_Info_Feeder	
	26	STA_MGCU_Power_Info_Feeder	
	27	STA_MGCU_Power_Info_Feeder	
	28	STA_MGCU_Power_Info_Feeder LSB	
	29	Central_Power_valid_On_Feeder	STA_MGCU_Power_Info_Feeder is capable for Centralized Power Control 0 = Not used or no Centralized Power Control available 1 = Centralized Power Control available
	30	Reserved	0
31	Reserved	0	

4	32	STA_MGCU_Power_Information MSB	Reserved	
	33	STA_MGCU_Power_Information		
	34	STA_MGCU_Power_Information		
	35	STA_MGCU_Power_Information		
	36	STA_MGCU_Power_Information		
	37	STA_MGCU_Power_Information		
	38	STA_MGCU_Power_Information		
	39	STA_MGCU_Power_Information		
5	40	STA_MGCU_Power_Information		
	41	STA_MGCU_Power_Information		
	42	STA_MGCU_Power_Information LSB		
	43	Reserved		0
	44	Reserved		0
	45	Reserved		0
	46	Reserved		0
6	48	STA_MGCU_Power_Control_Priority MSB	Reserved	
	49	STA_MGCU_Power_Control_Priority LSB		
	50	Reserved	0	
	51	Reserved	0	
	52	Reserved	0	
	53	Reserved	0	
	54	Reserved	0	
	55	Reserved	0	
7	56	Reserved	0	
	57	Reserved	0	
	58	Reserved	0	
	59	Reserved	0	
	60	Reserved	0	
	61	Reserved	0	
	62	Reserved	0	
	63	Reserved	0	

**Table 3-3: STA\_MGCU Data Field Format**

**NSD350-V-25-36-386**

Each STA\_MGCU message shall have the following components with the meaning as specified within the table below:

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
State	Integer	Legal modes are: 2 = Operational 3 = Maintenance 4 = Error
Disinfection Mode	Bit	Defines if A/C potable water system disinfection mode is active.  Potable water supply disinfection state: 0: no ongoing disinfection 1: ongoing disinfection

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
Implemented_Functionalies	Bit	<p>Defines which functionality is implemented. The device may have more than one functionality element implemented.</p> <p>Centralized Power Control 0: Not implemented 1: Implemented</p> <p>GAIN Remote Operation 0 = Not implemented 1 = Implemented</p> <p>Diagnostics 0: Not implemented 1: Implemented</p> <p>Data Transfer 0: Not implemented 1: Implemented</p>
Power_Info_Feeder	BIN	Denotes the feeder ID
Power_Information	BIN	Reserved
Power_Control_Priority	BIN	Reserved
Central_Power_Valid_On_Feeder	Bit	<p>Specific Feeder is capable for Centralized Power Control 0 = Not used or no Centralized Power Control available 1 = Centralized Power Control available</p>

Table 3-4: STA\_MGCU Signals

**NSD350-V-25-36-390**Signal **State**:

Following legal modes shall be applicable:

- 2 = Operational
- 3 = Maintenance
- 4 = Error

**NSD350-V-25-36-391**Signal **Disinfection Mode**:

Potable water supply disinfection state:

- 0: no ongoing disinfection
- 1: ongoing disinfection

Disinfection Mode behavior shall only be applicable to "Potable water" GAINs:

- In any states applicable GAIN shall go to the "Maintenance" state
- In status message a bit shall be set in Disinfection Mode
- Catering cycle shall stop within 5 seconds

- Unit shall continue in "Standby Off" state, when Disinfection Mode is finished.

**NSD350-V-25-36-392**

Signal **Implemented\_Functionalities:**

These Bits shall define which functionality is implemented. The device may have more than one functionality element implemented.

Centralized Power Control:

0: Not Implemented

1: Implemented

GAIN Remote Operation:

0: Not Implemented

1: Implemented

Diagnostics:

0: Not Implemented

1: Implemented

Data Transfer:

0: Not Implemented

1: Implemented

**NSD350-V-25-36-393**

Signal **Power\_Info\_Feeder:**

The MGCU shall cyclical iterate Power\_Info\_Feeder through all used feeders after each consecutive STA\_MGCU message.

**3.3.2.4 GAIN Life Pulse State STA\_GAIN**

**NSD350-V-25-36-396**

STA\_GAIN shall be periodically sent every TIMER\_STA\_GAIN time unless the GAIN node is in the CAN "bus off" state.

**NSD350-V-25-36-456**

STA\_GAIN shall be sent on event on every state transition(ref. to chapter 4 State Transitions) unless GAIN node is in the CAN "bus off"-state.

**NSD350-V-25-36-397**

STA\_GAIN message signals shall be used as specified within the table below:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	STA_GAIN_Mode MSB	Bits: 4 Coding: BIN Units: - Resolution: 1 Range: 0 - 15 0: Reserved 1: Centralized 2: Decentralized
	1	STA_GAIN_Mode	
	2	STA_GAIN_Mode	

	3	STA_GAIN_Mode LSB	3: Fallback 4: Workshop 5 – 15: Reserved
	4	STA_GAIN_State MSB	Bits: 4 Coding: BIN Units: - Resolution: 1 Range: 0 - 15 0: Reserved 1: Init 2: Standby ON 3: ON 4: Waiting 5: Interrupted 6: Finished 7: Maintenance 8: Error 9: Standby OFF 10: Stopped/aborted process 11 – 15: Reserved
	5	STA_GAIN_State	
	6	STA_GAIN_State	
	7	STA_GAIN_State LSB	
8	STA_GAIN_Used_Power_Budget MSB		
1	9	STA_GAIN_Used_Power_Budget	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
	10	STA_GAIN_Used_Power_Budget	
	11	STA_GAIN_Used_Power_Budget	
	12	STA_GAIN_Used_Power_Budget	
	13	STA_GAIN_Used_Power_Budget	
	14	STA_GAIN_Used_Power_Budget	
	15	STA_GAIN_Used_Power_Budget LSB	
2	16	STA_GAIN_Fallback_Power_Budget MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
	17	STA_GAIN_Fallback_Power_Budget	
	18	STA_GAIN_Fallback_Power_Budget	
	19	STA_GAIN_Fallback_Power_Budget	
	20	STA_GAIN_Fallback_Power_Budget	
	21	STA_GAIN_Fallback_Power_Budget	
	22	STA_GAIN_Fallback_Power_Budget	
23	STA_GAIN_Fallback_Power_Budget LSB		
3	24	STA_GAIN_PB_Remaining_Time MSB	Bits: 16 Coding: BIN Units: sec Resolution: 1 Range: 0-65534: remaining time 65535: indefinite time
	25	STA_GAIN_PB_Remaining_Time	
	26	STA_GAIN_PB_Remaining_Time	
	27	STA_GAIN_PB_Remaining_Time	
	28	STA_GAIN_PB_Remaining_Time	
	29	STA_GAIN_PB_Remaining_Time	
	30	STA_GAIN_PB_Remaining_Time	
31	STA_GAIN_PB_Remaining_Time		
4	32	STA_GAIN_PB_Remaining_Time	
	33	STA_GAIN_PB_Remaining_Time	
	34	STA_GAIN_PB_Remaining_Time	
	35	STA_GAIN_PB_Remaining_Time	
	36	STA_GAIN_PB_Remaining_Time	
	37	STA_GAIN_PB_Remaining_Time	
	38	STA_GAIN_PB_Remaining_Time	
	39	STA_GAIN_PB_Remaining_Time LSB	
5	40	STA_GAIN_Impl_Functionalities #0	GAIN Remote Operations 0: Not implemented 1: Implemented
	41	STA_GAIN_Impl_Functionalities #1	Centralized Power Control 0: Not implemented

			1: Implemented
	42	STA_GAIN_Impl_Functionalities #2	Decentralized Power Control 0: Not implemented 1: Implemented
	43	STA_GAIN_Impl_Functionalities #3	Diagnostics 0: Not implemented 1: Implemented
	44	STA_GAIN_Impl_Functionalities #4	Fallback Power Mode 0: Not implemented 1: Implemented
	45	STA_GAIN_Impl_Functionalities #5	Storage Function 0: Not implemented 1: Implemented.
	46	STA_GAIN_Impl_Functionalities #6	Data Transfer 0: Not implemented 1: Implemented
	47	STA_GAIN_Impl_Functionalities #7	Reserved
6	48	STA_GAIN_Power_Budget_Type	Reserved
	49	Reserved	0
	50	GAIN_Is_Primary	0: GAIN is secondary installed 1: GAIN is primary installed
	51	Feeder ID MSB	0...31: Feeder ID
	52	Feeder ID	
	53	Feeder ID	
54	Feeder ID		
55	Feeder ID LSB		
7	56	MGCU_Is_Present	0: absent 1: present
	57	Reserved	0
	58	Reserved	0
	59	Reserved	0
	60	Reserved	0
	61	Reserved	0
	62	Reserved	0
	63	Reserved	0

**Table 3-5: STA\_GAIN Data Field Format**

**NSD350-V-25-36-401**

Each STA\_GAIN message shall have the following components with the meaning specified within the table below:

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
Mode	Integer	Legal modes are: 1 = Centralized Power Control 3 = Fallback Power Control 4 = Workshop For Centralized Power Control, should be 1 if an MGCU_PC is present.
State	Integer	Legal states are: 1 = Init 2 = Standby ON 3 = On

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
		4 = Waiting 5 = Interrupted 6 = Finished 7 = Maintenance 8 = Error 9 = Standby OFF 10 = Stopped/aborted process It is not required that during init state will send a message.
Used_Power_Budget	VA	Used_Power_Budget is the GAIN Power consumption at the current operational state.
Fallback_Power_Budget	VA	Maximum usable power budget for GAIN, according to GAIN-Type:
Power_Budget_Remaining_Time	Seconds	The time remaining that the GAIN requires the use of the Power Budget VA.
Implemented_Functionalities	Bit-Map	Defines the capabilities implemented in the GAIN. Legal fields will only be: Bit 40 = 1, Remote Operation capable Bit 41 = 1, Centralized Power Control capable Bit 42 = 1, Decentralized Power Control capable Bit 43 = 1, Diagnostics capable Bit 44 = 1, Fallback Power Mode capable Bit 45 = 1, Storage function capable Bit 46 = 1 Data Transfer capable
Power_Budget_Type	Bit	Reserved (not used)
GAIN_Is_Primary	Bit	0 = Secondary 1 = Primary
Feeder_ID	Integer	Feeder ID number reflected from Pin Programming discrettes.
MGCU_is_Present	Bit	0 = Absent 1 = Present

Table 3-6: STA\_GAIN components

**NSD350-V-25-36-405**Signal **Mode**:

Legal modes shall be:

1 = Centralized Power Control

3 = Fallback Power Control

4 = Workshop

For centralized power control shall be 1 if an MGCU\_PC is present.

**NSD350-V-25-36-406**Signal **State**:

Legal states shall be:

1 = Init

2 = Standby On

- 3 = On
- 4 = Waiting
- 5 = Interrupted
- 6 = Finished
- 7 = Maintenance
- 8 = Error
- 9 = Standby Off
- 10 = Stopped/Aborted process

It is not required that during "Initialization" state a message is sent.

**NSD350-V-25-36-407**

Signal **Used\_Power\_Budget**:

Used\_Power\_Budget shall be GAIN Power consumption at the current operational state.

**NSD350-V-25-36-408**

Signal **Fallback\_Power\_Budget**:

Fallback\_Power\_Budget shall be set to MAXIMUM\_POWER\_BUDGET in case GAIN-Type is Primary (as defined by pin programming)

**NSD350-V-25-36-409**

Signal **Fallback\_Power\_Budget**:

Fallback\_Power\_Budget shall be set to STANDBY\_POWER\_BUDGET in case GAIN-Type is Secondary (as defined by pin programming)

**NSD350-V-25-36-410**

Signal **Power\_Budget\_Remaining\_Time**:

Remaining Time shall be calculated as a count-down timer, in conjunction with Used\_Power\_Budget, while the GAIN is in the 'On' state or in the 'Waiting' state.

Note: This value should be internally updated before each STA\_GAIN message is sent.

**NSD350-V-25-36-412**

Signal **Implemented\_Functionalities**:

Every GAIN shall have the following bits set if the function is implemented.

- Bit 40 = 1, Remote Operation Capable
- Bit 41 = 1, Centralized Power Control capable
- Bit 42 = 1, Decentralized Power Control capable
- Bit 43 = 1, Diagnostics capable
- Bit 44 = 1, Fallback Power Mode capable
- Bit 45 = 1, Storage function capable
- Bit 46 = 1, Data Transfer capable

**NSD350-V-25-36-413**

Signal **Implemented\_Functionalities**:

Every GAIN shall be capable of Fallback Power Mode.

**NSD350-V-25-36-417**

Signal **GAIN\_Is\_Primary**:

Legal values shall be:

0 = GAIN is Secondary  
1 = GAIN is Primary

**NSD350-V-25-36-418**Signal **GAIN\_Is\_Primary:**

This value shall be set to 0 if GAIN detects a Pin Programming Error.

**NSD350-V-25-36-419**Signal **Feeder\_ID:**

This value shall be set to 0 if GAIN detects a Pin Programming Error.

**NSD350-V-25-36-420**Signal **MGCU\_Is\_Present:**

Legal values shall be:

0 = absent

1 = present

**NSD350-V-25-36-421**Signal **MGCU\_Is\_Present:**

This value shall be set to 0 if the corresponding MGCU is absent. If the MGCU is considered as present the value has to set to 1.

**3.3.2.4.1 Detection of GAIN Presence/Absence**

GAIN Communication Counter and Timer Values (Stored in NVM), Configuration Data Block 12, GAIN Counter Management.

<i>Item</i>	<i>Units</i>	<i>Definition</i>
GAIN_COUNTER_DELTA_INC	Integer	The value that will be added to a GAIN timeout counter. Default: 1
GAIN_COUNTER_DELTA_DEC	Integer	The value that will be subtracted from an GAIN timeout counter. Default: 1
GAIN_COUNTER_THRESHOLD	Integer	The threshold limit by which a GAIN timeout counter will be compared. Default: 3
TIMER_STA_GAIN	Ms	The periodic rate at which an GAIN sends its STA_GAIN life guarding message. Default: 1000 ms
TIMER_STA_TIMEOUT_GAIN	Ms	The time after which an GAIN timeout is noted. Default: 1200 ms

**Table 3-7: GAIN Counter Timer Values**

GAIN connection timeout time = GAIN\_COUNTER\_DELTA\_INC \*  
GAIN\_COUNTER\_THRESHOLD \* TIMER\_STA\_TIMEOUT\_GAIN

GAIN connection established time = GAIN\_COUNTER\_DELTA\_DEC \*  
GAIN\_COUNTER\_THRESHOLD \* TIMER\_STA\_TIMEOUT\_GAIN

**NSD350-V-25-36-431**

If STA\_GAIN message is not received within GAIN connection timeout time, the GAIN shall be considered as "absent" from the network.

**NSD350-V-25-36-432**

If the quantity of GAIN\_COUNTER\_THRESHOLD\_STA\_GAIN messages are received within GAIN connection established time, the GAIN shall be considered as "present" on the network.

**3.3.2.5 Flight Information FLIGHT\_INFO****NSD350-V-25-36-433**

The FLIGHT\_INFO message shall be sent by the MGCU.

**NSD350-V-25-36-434**

In the event of no Flight Info reception, GAINs shall assume a default flight phase of 0.

**NSD350-V-25-36-435**

Following table specifies the signals that shall be used for the FLIGHT\_INFO message:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	FLIGHT_INFO_Year MSB	Bits: 8 Coding: BIN Units: Year Resolution: 1 Range: 0-99: Year 100-254: Reserved 255: Not applicable COMMENTARY '0' means 'year 2000'
	1	FLIGHT_INFO_Year	
	2	FLIGHT_INFO_Year	
	3	FLIGHT_INFO_Year	
	4	FLIGHT_INFO_Year	
	5	FLIGHT_INFO_Year	
	6	FLIGHT_INFO_Year	
	7	FLIGHT_INFO_Year LSB	
1	8	FLIGHT_INFO_Month MSB	Bits: 4 Coding: BIN Units: Month Resolution: 1 0: Not applicable signal 1-12: month 13-15: reserved
	9	FLIGHT_INFO_Month	
	10	FLIGHT_INFO_Month	
	11	FLIGHT_INFO_Month LSB	
	12	Reserved	
	13	Reserved	
	14	Reserved	
2	16	FLIGHT_INFO_Day MSB	Bits: 5 Coding: BIN Units: Day Resolution: 1
	17	FLIGHT_INFO_Day	
	18	FLIGHT_INFO_Day	

	19	FLIGHT_INFO_Day	Range: 0: Not applicable signal 1-31: day
	20	FLIGHT_INFO_Day LSB	
	21	Reserved	0
	22	Reserved	0
	23	Reserved	0
3	24	FLIGHT_INFO_Hour MSB	Bits: 5 Coding: BIN Units: Hours Resolution: 1
	25	FLIGHT_INFO_Hour	
	26	FLIGHT_INFO_Hour	
	27	FLIGHT_INFO_Hour	
	28	FLIGHT_INFO_Hour LSB	Range: 0...23: Hour 24...31: Reserved
	29	Reserved	0
	30	Reserved	0
4	31	Reserved	0
	32	FLIGHT_INFO_Minute MSB	Bits: 6 Coding: BIN Units: Minutes Resolution: 1
	33	FLIGHT_INFO_Minute	
	34	FLIGHT_INFO_Minute	
	35	FLIGHT_INFO_Minute	
	36	FLIGHT_INFO_Minute	
	37	FLIGHT_INFO_Minute LSB	Range: 0...59: Minute 60...63: Reserved
38	Reserved	0	
5	39	Reserved	0
	40	FLIGHT_INFO_Seconds MSB	Bits: 6 Coding: BIN Units: Seconds Resolution: 1
	41	FLIGHT_INFO_Seconds	
	42	FLIGHT_INFO_Seconds	
	43	FLIGHT_INFO_Seconds	
	44	FLIGHT_INFO_Seconds	
	45	FLIGHT_INFO_Seconds LSB	Range: 0...59: Minute 60...63: Reserved
46	Reserved	0	
6	47	Reserved	0
	48	FLIGHT_INFO_Flight_Phase MSB	Bits: 4 Coding: BIN Units: - Resolution: 1  Range: 0 - 15 0: Default 1: Parking/Pre Flight 2: Taxi Out 3: Take Off 1 <sup>st</sup> Step 4: Take Off 2 <sup>nd</sup> Step 5: Take Off 3 <sup>rd</sup> Step 6: Climb 1 <sup>st</sup> Step 7: Climb 2 <sup>nd</sup> Step 8: Cruise 9: Approach 10: Landing 11: Runway exit 12: Taxi In 13: Parking/Post Flight 14 - 15: Reserved
	49	FLIGHT_INFO_Flight_Phase	
	50	FLIGHT_INFO_Flight_Phase	
51	FLIGHT_INFO_Flight_Phase LSB		

	52	Reserved	0
	53	Reserved	0
	54	Reserved	0
	55	Reserved	0
7	56	Reserved	0
	57	Reserved	0
	58	Reserved	0
	59	Reserved	0
	60	Reserved	0
	61	Reserved	0
	62	Reserved	0
	63	Reserved	0

Table 3-8: FLIGHT\_INFO Data Field Format

### 3.3.2.6 Flight Data

#### NSD350-V-25-36-440

Flight data shall be stored within GAIN's Configuration Data Block No. 8.

#### NSD350-V-25-36-441

Flight data shall be send by the MGCU using the Data Upload Service.

### 3.3.3 System Expanded Service (SES Messages)

The System Expanded Service messages are general purpose messages that originate from a different system, or messages that require an expanded capability beyond the currently defined ARINC 812-style messages.

The SES message should be used as a generic message for a direct communication path between system internal equipments and external other aircraft system.

There will be 2 such messages:

- ♣ The SES\_MGCU message, which is a message originating from an external system and passing thru the MGCU to the GAIN

- ♣ The SES\_GAIN message, which is a message originating from specialized GAIN that handles messages from an external system, passing thru the MGCU.

These generic message formats are detailed below.

Specific implementation for these SES-style messages will be contained in separate Technical Notes, where appropriate for this specialized GAIN requiring communication to some external system beyond the galley network.

#### 3.3.3.1 SES\_MGCU Message

This message, in the A350 galley, is a message that originates in some defined external system and provides remote commands to a specialized SES GAIN. The MGCU is the sender of this message that acts as a router to the SES-enabled GAIN from the external system beyond the galley network.

#### NSD350-V-25-36-463

The SES\_MGCU message shall have the following CAN 29-bit identifier noted in the able below:

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	2	Normal Operation Channel (One-to-Many)
Sender: FID	0x58 (88d)	Functional ID is 0x58 (88d) for Supplemental Cooling System
RSD	0	For One-to-Many, the Reserved Bit is 0
LCL	0	0 = Not local
PVT	0	0 = Not Private
Message Code	0x18 (24d)	Value of SES_MGCU message code
Receiver: Device ID	1...127	GAIN Device ID (node address)
RCI	0	Redundancy Channel is 0

**Table 3-9: SES\_MGCU Message Identifier****NSD350-V-25-36-466**

The SES\_MGCU shall be sent by the MGCU upon reception from the external system, subject to the general inhibit time rate of 200 ms.

**NSD350-V-25-36-467**

An SES-enabled GAIN shall monitor and process the SES\_MGCU upon message reception.

Table below lists the signal incorporated into the SES\_MGCU message.

<i>Signal Name</i>	<i>Comments</i>
All signals undefined.	Message signals are subject to additional technical definition from external documents.

**Table 3-10: SES\_MGCU Signals****NSD350-V-25-36-472**

The following content and format of the SES\_MGCU message shall:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0-7	All	Opaque Data	Defined in other external specification applicable to the SES-enabled system.

**Table 3-11: SES\_MGCU Message Format****3.3.3.2 SES\_GAIN Message**

This message, in the A350 galley, is a message that originates in the Galley System and provides status information from an SES-enabled GAIN to the external system beyond the

galley network. The MGCU is the receiver of this message that acts as a router to the SES-enabled system.

**NSD350-V-25-36-477**

The SES\_GAIN message shall have the following CAN 29-bit identifier as noted in table below:

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	2	Normal Operation Channel (One-to-Many)
Sender: FID	0x7B (123d)	Functional ID is 0x7B (123d) for Galley System
RSD	0	For One-to-Many, the Reserved Bit is 0
LCL	0	0 = Not local
PVT	0	0 = Not Private
Message Code	0x19 (25d)	Value of SES_GAIN message code
Receiver: Device ID	1...127	MGCU Device ID (node address)
RCI	0	Redundancy Channel is 0

**Table 3-12: SES\_GAIN Message Identifier****NSD350-V-25-36-480**

The SES\_GAIN shall be sent by the SES-enabled GAIN at a periodic rate ms (Configuration Data Block 10, SES\_GAIN\_TIMER).

Table below lists the signal incorporated into the SES\_MGCU message.

<i>Signal Name</i>	<i>Comments</i>
All signals undefined.	Message signals are subject to additional technical definition from external documents.

**Table 3-13: SES\_GAIN Signals****NSD350-V-25-36-484**

The following content and format of the SES\_MGCU message shall apply (noted in table below):

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0-7	All	Opaque Data	Defined in other external specification applicable to the SES-enabled GAIN.

**Table 3-14: SES\_GAIN\_Message Format**

## 3.4 Data Transfer

### 3.4.1 Overview

Data transfer functionalities will be used to up- and download GAIN configuration data. Common requirements for Data transfer are:

#### **NSD350-V-25-36-488**

Only the MGCU shall be able to send a Data Upload or Data Download Request. A GAIN shall not be able to start a transmission for itself, as such, a GAIN shall never send a Data Upload or Data Download Request.

#### **NSD350-V-25-36-489**

The correctness of the data transfer shall be checked by calculating a checksum of the received data and by comparing this checksum with the checksum provided by the sender. This is a CRC-32 checksum, as noted in ARINC 825.

#### **NSD350-V-25-36-490**

In case of a correct data transfer, the receiver shall send a Data Upload/Download Acknowledge Response with a Response Code of 1 (Checksum Okay).

#### **NSD350-V-25-36-491**

In case of corrupted data, the receiver shall send a Data Upload/Download Acknowledge Response with a Response Code of -1 (Checksum Error).

#### **NSD350-V-25-36-492**

In case of corrupted data, the receiver shall send a DIAG\_MALFUNCTION "Data transmission error" message.

#### **NSD350-V-25-36-493**

The SEQUENCE\_TIMEOUT\_TIMER shall be used to observe the correct data transfer message timing.

#### **NSD350-V-25-36-494**

In case of a timeout the GAIN shall send DIAG\_WARNING message with the "Data transmission interrupted" set and continue with normal operation.

#### **NSD350-V-25-36-495**

Data download shall be possible as long as a GAIN is not in an 'Error' state.

#### **NSD350-V-25-36-496**

Data upload shall be limited for "FLIGHT\_DATA" Configuration Data Block only.

#### **NSD350-V-25-36-497**

The data transfer frames shall be discarded unless the transfer packets have been received in their entirety.

**NSD350-V-25-36-807**

Only complete configuration data blocks shall be transferred.  
Note: parameter and subparameter transfers are not supported.

**NSD350-V-25-36-808**

In case of a response code other than 1 (Acknowledge) all participants shall abort the data transfer sequence.

**3.4.2 Data Transfer Protocol****NSD350-V-25-36-498**

The data block shall be identified by "data block number" and "data block parameter number"

**NSD350-V-25-36-499**

A "data block parameter number" of -1 shall transfer the whole data block.

**NSD350-V-25-36-500**

The maximum amount of data volume per transmission sequence shall be limited to 16 split data messages each containing 8 Byte data payload, except the final data message may contain less than 8 bytes.

**NSD350-V-25-36-820**

For the data upload and download the checksum used, shall be a CRC-32 defined by the polynomial:  $x^{32}+x^{26}+x^{23}+x^{22}+x^{16}+x^{12}+x^{11}+x^{10}+x^8+x^7+x^5+x^4+x^2+x+1$ .  
For CRC-32 calculation, 0xFFFFFFFF shall be used for the initialCRC value. The final value shall be exclusive-or'd with 0xFFFFFFFF.

Note: a CRC-32 calculation algorithm that evaluates the following character string, "123456789" to 0xCBf43926 calculates the CRC-32 correctly.

Example: Description of Configuration data block #8 "Flight Data"

Block size is 25 byte, City Pair From is set to "LNZ", City Pair To is set to "HAM", Flight Number is "123456789" and Aircraft ID is "123456".

Each string is zero terminated.

In C-notation, configuration data block #8 is defined as below, byte values are given for each data field:

```
typedef struct
{
char CityPairFrom[4]; // 4C 4E 5A 00 "LNZ"
char CityPairTo[4]; // 48 41 4D 00 "HAM"
char FlightNumber[10]; // 31 32 33 34 35 36 37 38 39 00 "123456789"
char AircraftID[7]; // 31 32 33 34 35 36 00 "123456"
} GAINConfigurationDataBlock08;
```

So GAIN data block #8 is represented in memory by following byte sequence:  
4C 4E 5A 00 48 41 4D 00 31 32 33 34 35 36 37 38 39 00 31 32 33 34 35 36 00

Using the CRC32 algorithm defined above, CRC32 calculates to 0x18BB40BD.

Data download example for Configuration data block #8 "Flight Data"

Downloading data block #8 from a GAIN with device ID 1 leads to following sequence:

1.) MGCU => GAIN: Message: 0x13DEF604, DLC: 4, data: 00 03 88 FF  
Data Download Request, configuration data block #8, whole block

Remark: total transfer size, including CRC32, is 29 byte.

2.) GAIN => MGCU: Message: 0x13DAF604, DLC: 8, data: 00 03 01 01 00 00 00 1D  
Data Download Response, configuration data block size is 29 (0x0000001D)  
Remark: please note big endian ordering for 32 bit value!

3.) MGCU => GAIN: Message: 0x13DEF604, DLC: 8, data: 00 03 01 40 01 00 01 00  
Data Download Request #2, minimumMessageSeperationTime == 64 (0x40),  
transferBlockSize == 256 (0x0100), minimumBlockSeperationTime == 256 (0x0100)  
Remark: please note big endian ordering for 16 bit values!

4.) GAIN => MGCU: Message: 0x13DAF604, DLC: 8, data: 00 03 01 40 00 40 01 00  
Data Download Response #2, minimumMessageSeperationTime == 64 (0x40),  
transferBlockSize == 64 (0x0040), minimumBlockSeperationTime == 256 (0x0100)  
Remark: please note big endian ordering for 16 bit values!

5.) GAIN => MGCU: Message: 0x13DBF604, DLC: 8, data: 4C 4E 5A 00 48 41 4D 00  
Data Download Packet, byte #0 to #7, 21 byte remaining

6.) GAIN => MGCU: Message: 0x13DBF604, DLC: 8, data: 31 32 33 34 35 36 37 38  
Data Download Packet, byte #8 to #15, 13 byte remaining

7.) GAIN => MGCU: Message: 0x13DBF604, DLC: 8, data: 39 00 31 32 33 34 35 36  
Data Download Packet, byte #16 to #23, 5 byte remaining

8.) GAIN => MGCU: Message: 0x13DBF604, DLC: 8, data: 00 18 BB 40 BD 00 00 00  
Data Download Packet, byte #24 to #28, 0 byte remaining

Remark: Last Data Download Packet contains last byte of data and 4 byte CRC32: 18 BB 40 BD. Byte #5 to byte #7 are "don't care".

Remark: please note big endian ordering for 32 bit CRC32!

9.) MGCU => GAIN: Message: 0x13DEF604, DLC: 3, data: 00 03 01  
Data Transfer: Data Download Acknowledge

Data upload example for Configuration data block #8 "Flight Data"

Uploading data block #8 to a GAIN with device ID 1 leads to following sequence:

1.) MGCU => GAIN: Message: 0x13DEF604, DLC: 8, data: 00 02 88 FF 00 00 00 1D  
Data Upload Request, configuration data block #8, whole block, 29 byte (0x0000001D)

Remark: total transfer size, including CRC32, is 29 byte. Please note big endian ordering for 32 bit value!

2.) GAIN => MGCU: Message: 0x13DAF604, DLC: 8, data: 00 02 01 FA 00 40 02 00  
Data Upload Response, minimumMessageSeperationTime == 250 (0xFA), transferBlockSize == 64 (0x0040), minimumBlockSeperationTime == 512 (0x0200)  
Remark: please note big endian ordering for 16 bit values!

3.) MGCU => GAIN: Message: 0x13DEF604, DLC: 8, data: 00 02 01 FA 00 40 02 00  
Data Upload Request #2, minimumMessageSeperationTime == 250 (0xFA),  
transferBlockSize == 64 (0x0040), minimumBlockSeperationTime == 512 (0x0200)  
Remark: please note big endian ordering for 16 bit values!

4.) GAIN => MGCU: Message: 0x13DAF604, DLC:3, data: 00 02 01  
Data Upload Response #2

5.) MGCU => GAIN: Message: 0x13DFF604, DLC: 8, data: 4C 4E 5A 00 48 41 4D 00  
Data Upload Packet, byte #0 to #7, 21 byte remaining

6.) MGCU => GAIN: Message: 0x13DFF604, DLC: 8, data: 31 32 33 34 35 36 37 38  
Data Upload Packett, byte #8 to #15, 13 byte remaining

7.) MGCU => GAIN: Message: 0x13DFF604, DLC: 8, data: 39 00 31 32 33 34 35 36  
Data Upload Packet, byte #16 to #23, 5 byte remaining

8.) MGCU => GAIN: Message: 0x13DFF604, DLC: 8, data: 00 18 BB 40 BD 00 00 00  
Data Upload Packet, byte #24 to #28, 0 byte remaining

Remark: Last Data Upload Packet contains last byte of data and 4 byte CRC32: 18 BB 40 BD. Byte #5 to byte #7 are "don't care".

Remark: please note big endian ordering for 32 bit CRC32!

9.) GAIN => MGCU: Message: 0x13DAF604, DLC: 3, data: 00 02 01  
Data Transfer: Data Upload Acknowledge

### 3.4.2.1 Service Function Codes

<i>Message Name</i>	<i>Service Function Code</i>	<i>Hex</i>
Data Upload	2	0x0002
Data Download	3	0x0003

**Table 3-15: Data Transfer Service Function Codes**

### 3.4.2.2 Data Transfer CAN Message Request Identifier

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	4	NSC
Client FID	123	FID is123 (Galley Inserts)
SMT	1	Service Message Type is Request
LCL	1	local bus only
PVT	0	Non-opaque data
Server FID	123	FID is123 (Galley Inserts)
SID	0...127	Multicast: 0 Device identifier: 1...127

RCI	0	Redundancy Channel is 0
-----	---	-------------------------

Table 3-16: Data Transfer CAN Message Request Identifier

## 3.4.2.3 Data Transfer CAN Message Response Identifier

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	4	NSC
Client FID	123	FID is123 (Galley Inserts)
SMT	0	Service Message Type is Response
LCL	1	local bus only
PVT	0	Non-opaque data
Server FID	123	FID is123 (Galley Inserts)
SID	1...127	Device identifier: 1...127
RCI	0	Redundancy Channel is 0

Table 3-17: Data Transfer CAN Message Response Identifier

## 3.4.2.4 Data Transfer CAN Message Data Identifier

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	4	NSC
Client FID	123	FID is123 (Galley Inserts)
SMT	0/1	Service Message Type is Server => Client (Download) or Client => Server (Upload)
LCL	1	local bus only
PVT	1	Opaque data
Server FID	123	FID is123 (Galley Inserts)
SID	0...127	Multicast: 0 (MGCU only) Device identifier: 1...127
RCI	0	Redundancy Channel is 0

Table 3-18: Data Transfer CAN Message Data Identifier

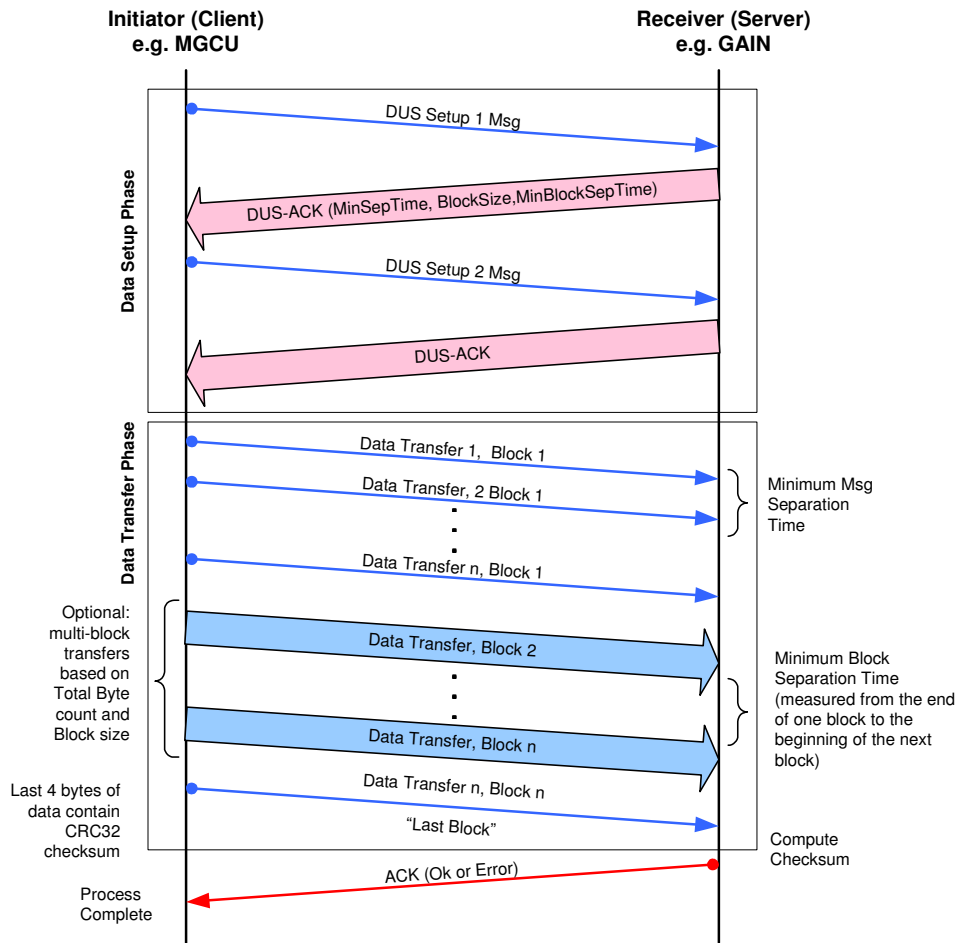
## 3.4.2.5 Data Transfer Message Packet

<i>Byte</i>	<i>Data</i>	<i>Designation</i>
0	Data Byte #0	Data payload
1	Data Byte #1	
2	Data Byte #2	
3	Data Byte #3	
4	Data Byte #4	
5	Data Byte #5	
6	Data Byte #6	
7	Data Byte #7	

**Table 3-19: Data Transfer Packet**

**3.4.3 Data Upload Service**

**Data Upload Service (DUS)**



**Figure 3-1: Data Upload Transfer Sequence**

**NSD350-V-25-36-518**

MGCU shall select the device(s) which act(s) as Receivers by sending a Data Upload Request message to start the transmission sequence.

**NSD350-V-25-36-519**

If a Data Upload Request is send to a non-zero SID (peer to peer), all respective GAIN shall send a Data Upload Response.

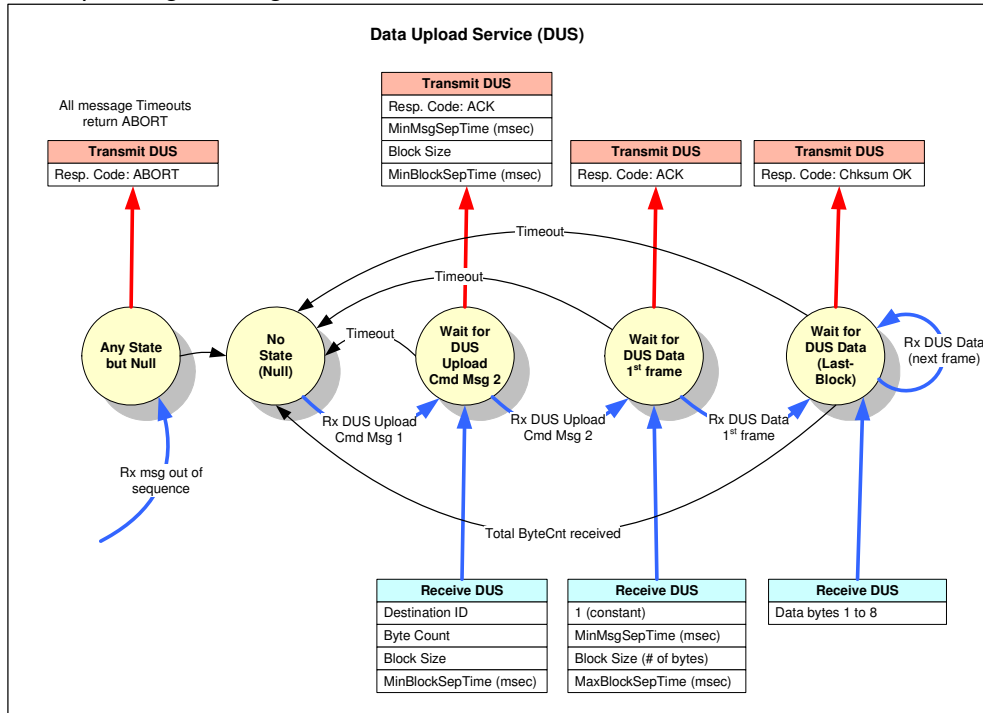
**NSD350-V-25-36-520**

If a Data Upload Request is send to SID 0 (Multicast), each GAIN shall send a Data Upload Response.

**NSD350-V-25-36-521**

GAINs shall reply with a Data Upload Response message within SEQUENCE\_TIMEOUT\_TIMER milliseconds (Configuration Data Block 9, GAIN Timers).

The following figure demonstrates the Data Upload Service transitions with the corresponding messages from this section.



**Figure 3-2: Data Upload Service Transitions with Messages**

**3.4.3.1 Data Upload Request Message**

Message code is DT\_REQ. Data length code is 8.

Byte	Data	Designation	Remarks
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x02	
2	Destination ID MSB	Bits: 8 Coding: BIN Resolution: 1 Range: 129...191: Config data blocks #1...#63 192...255: Vendor defined data blocks #64...#127  Remarks: Config Data Block Number := Destination ID MSB - 128	Destination IDs in the range from 0 to 1023 are defined/reserved by ARINC 825, hence we always set Bit 7 of Destination ID MSB. This will allow for a maximum of 127 data blocks.
3	Destination ID LSB	0xFF	
4	Total Byte Count #0 MSB	Total number of bytes to transmit, including the 4-Byte Checksum	

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
5	Total Byte Count #1		
6	Total Byte Count #2		
7	Total Byte Count #3 LSB		

Table 3-20: Data Upload Request Message

### 3.4.3.2 Data Upload Response Message

Message code is DT\_RES. Data length code is 8.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x02	
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -3 = Out of Space -2 = Invalid Destination -1 = Abort 1 = Acknowledge	
3	Minimum Message Separation Time	Minimum Message Separation Time in milliseconds Bits: 8 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...255	
4	Block Size MSB	Block Size as number of Bytes Bits: 16 Coding: BIN Units: Byte Resolution: 1 Range: 0...65535	
5	Block Size LSB		
6	Minimum Block Separation Time MSB	Minimum Block Separation Time in milliseconds Bits: 16 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...65535	
7	Minimum Block Separation Time LSB		

Table 3-21: Data Upload Response Message

#### NSD350-V-25-36-809

If "Destination ID" in "Data Upload Request Message" is not equal to 8, the GAIN shall respond with a response code of -2 "Invalid destination".

**NSD350-V-25-36-810**

If "Total Byte Count" in "Data Upload Request Message" doesn't match the size a GAIN expects, the GAIN shall respond with a response code of -3 "Out of space".

**3.4.3.3 Data Upload Request Message #2**

Message code is DT\_REQ. Data length code is 8.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x02	
2		1 (constant)	
3	Minimum Message Separation Time	Minimum Message Separation Time in milliseconds Bits: 8 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...255	
4	Block Size MSB	Block Size as number of Bytes Bits: 16 Coding: BIN Units: Byte Resolution: 1 Range: 0...65535	
5	Block Size LSB		
6	Minimum Block Separation Time MSB	Minimum Block Separation Time in milliseconds Bits: 16 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...65535	
7	Minimum Block Separation Time LSB		

**Table 3-22: Data Upload Request Message #2**

**NSD350-V-25-36-537**

Minimum Message Separation Time shall be determined by the value Minimum Message Separation Time received from the GAIN in message Data Upload Response.

**NSD350-V-25-36-538**

If a Data Upload Request was sent to SID 0 (Broadcast), Minimum Message Separation Time shall be determined by the highest value Minimum Message Separation Time received from all GAINs in message Data Upload Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-539**

The MGCU shall wait at least as many milliseconds as specified in field Minimum Message Separation Time between two CAN data transfer messages.

**NSD350-V-25-36-540**

Minimum Block Separation Time shall be determined by the value Minimum Block Separation Time received from the GAIN in message Data Upload Response.

**NSD350-V-25-36-541**

If a Data Upload Request was sent to SID 0 (Broadcast), Minimum Block Separation Time shall be determined by the highest value Minimum Block Separation Time received from all GAINs in message Data Upload Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-542**

The MGCU shall wait at least as many milliseconds between two data blocks as specified in field Minimum Block Separation Time.

**NSD350-V-25-36-543**

Block Size shall be determined by the value Block Size received from the GAIN in message Data Upload Response

**NSD350-V-25-36-544**

If a Data Upload Request was sent to SID 0 (Broadcast), Block Size shall be determined by the lowest value Block Size received from all GAINs in message Data Upload Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-545**

The MGCU shall not send more data bytes for each data block than is specified in the field Block Size.

**NSD350-V-25-36-546**

The Minimum Message Separation shall not be less than the general message Inhibit Timer DTA (Configuration Data Block values for both GAIN and MGCU).

**3.4.3.4 Data Upload Response Message #2**

Data Message code is DT\_RES. Length code is 3.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x02	
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -4 = Invalid Data -3 = Out of Space -2 = Invalid Destination -1 = Abort 1 = Acknowledge	

**Table 3-23: Data Upload Response Message #2**

Response code "-4 Invalid Data" and "-3 Out of Space" will not be used.

**3.4.3.5 Data Upload Acknowledge Response #2**

Message code is DT\_RES. Data length code is 3.

Byte	Data	Designation	Remarks
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x02	
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -1 = Checksum Error 1 = Checksum Okay	

Table 3-24: Data Upload Acknowledge Response #2

### 3.4.4 Data Download Service

#### Data Download Service (DDS)

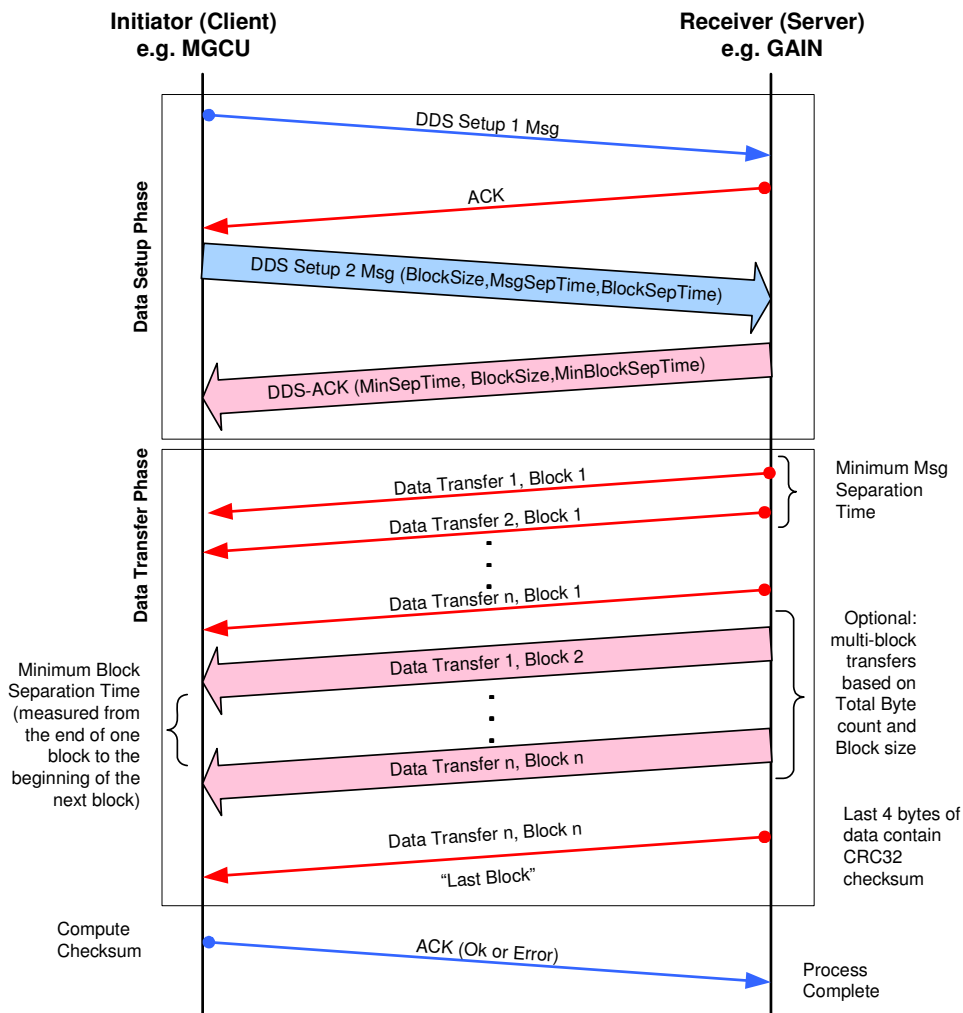


Figure 3-3: Data Download Transfer Sequence

**NSD350-V-25-36-557**

MGCU shall select the device(s) which act(s) as Senders by sending a Data Download Request message to start the transmission sequence.

**NSD350-V-25-36-558**

If a Data Download Request is sent to a non-zero SID (peer to peer), the respective GAIN shall send a Data Download Response.

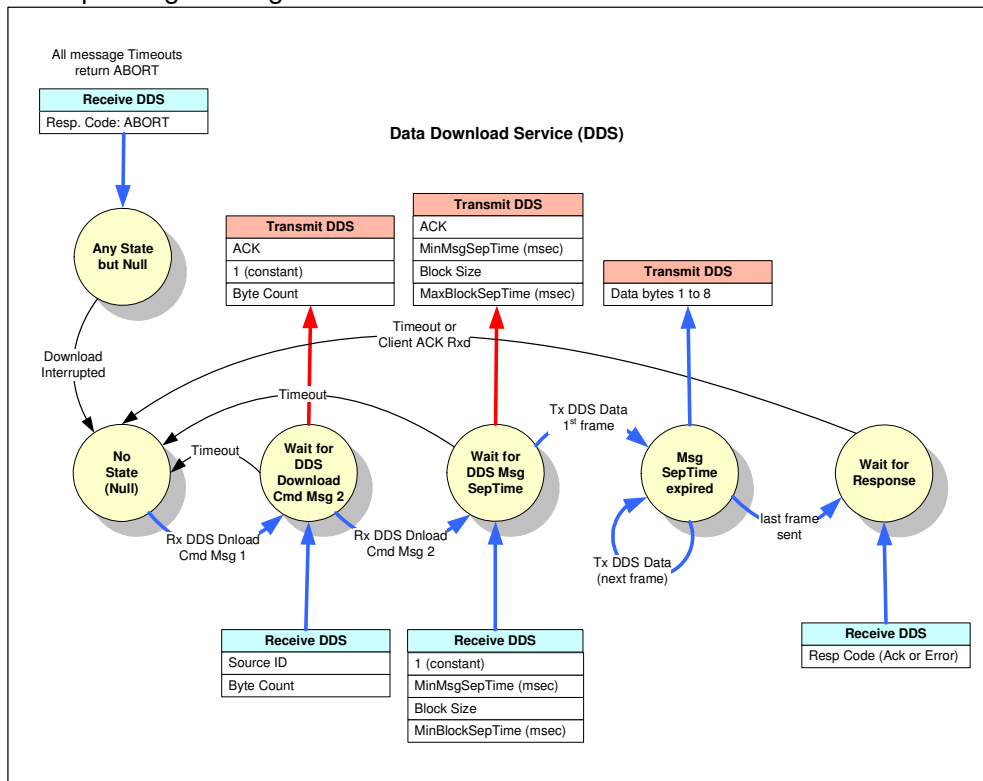
**NSD350-V-25-36-559**

If a Data Download Request is sent to SID 0 (Multicast), each GAIN shall send a Data Download Response.

**NSD350-V-25-36-560**

GAINs shall reply with a Data Download Response message within SEQUENCE\_TIMEOUT\_TIMER milliseconds (Configuration Data Block 9, GAIN Timers).

The following figure demonstrates the Data Download Service transitions with the corresponding messages from this section:



**Figure 3-4: Data Download Service Transitions with Messages**

**3.4.4.1 Data Download Request Message**

Message code is DT\_REQ. Data length code is 4.

Byte	Data	Designation	Remarks
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x03	
2	Source ID	Bits: 8	Source IDs in the range from

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
	MSB	Coding: BIN Resolution: 1 Range: 129...255 (bit 7 always set) Remarks: Config Data Block Number := Destination ID MSB	0 to 1023 are defined/reserved by ARINC 825, hence we always set Bit 7 of Source ID MSB. This will allow for a maximum of 127 data blocks.
3	Source ID LSB	0xFF	

Table 3-25: Data Download Request Message

### 3.4.4.2 Data Download Response Message

Message code is DT\_RES. Data length code is 8.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x03	
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -2 = Invalid Source -1 = Abort 1 = Acknowledge	
3	Constant	1 (constant)	
4	Total Byte Count #0 MSB	Total number of bytes to transmit, including the 4-Byte Checksum	
5	Total Byte Count #1		
6	Total Byte Count #2		
7	Total Byte Count #3 LSB		

Table 3-26: Data Download Response Message

#### NSD350-V-25-36-811

If "Source ID" in "Data Download Request Message" is not a defined configuration data block number, the GAIN shall respond with a response code of -2 "Invalid source".

### 3.4.4.3 Data Download Request Message #2

Message code is DT\_REQ. Data length code is 8.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x03	
2	Constant	0x01	
3	Minimum Message Separation Time	Minimum Message Separation Time in milliseconds Bits: 8 Coding: BIN Units: Milliseconds Resolution: 1	

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
		Range: 0...255	
4	Block Size MSB	Block Size as number of Bytes Bits: 16 Coding: BIN	
5	Block Size LSB	Units: Byte Resolution: 1 Range: 0...65535	
6	Minimum Block Separation Time MSB	Minimum Block Separation Time in milliseconds Bits: 16 Coding: BIN	
7	Minimum Block Separation Time LSB	Units: Milliseconds Resolution: 1 Range: 0...65535	

**Table 3-27: Data Download Request Message #2****NSD350-V-25-36-576**

Minimum Message Separation Time shall be determined by the time the MGCU needs to handle incoming data in worst case.

**NSD350-V-25-36-577**

If a Data Download Request was sent to SID 0 (Multicast), Minimum Message Separation Time shall be determined by the highest value Minimum Message Separation Time received from all GAINs in message Data Download Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-578**

The GAIN shall wait at least as many milliseconds as specified in field Minimum Message Separation Time between two CAN data transfer messages.

**NSD350-V-25-36-579**

Minimum Block Separation Time shall be determined by the value Minimum Block Separation Time received from the MGCU in message Data Download Response

**NSD350-V-25-36-580**

If a Data Download Request was sent to SID 0 (Multicast), Minimum Block Separation Time shall be determined by the highest value Minimum Block Separation Time received from all GAINs in message Data Download Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-581**

The GAIN shall wait at least as many milliseconds between two data blocks as specified in field Minimum Block Separation Time.

**NSD350-V-25-36-582**

Block Size shall be determined by the value Block Size received from the MGCU in message Data Download Response.

**NSD350-V-25-36-583**

If a Data Download Request was sent to SID 0 (Multicast), Block Size shall be determined by the lowest value Block Size received from all GAINs in message Data Download Response with Response Code 1 (Acknowledge).

**NSD350-V-25-36-584**

The GAIN shall not send more data bytes for each data block than is specified in the field Block Size.

**3.4.4.4 Data Download Response Message #2**

Message code is DT\_RES. Data length code is 8.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x03	
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -4 = Invalid Data -1 = Abort 1 = Acknowledge	
3	Minimum Message Separation Time	Minimum Message Separation Time in milliseconds Bits: 8 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...255	
4	Block Size MSB	Block Size as number of Bytes Bits: 16 Coding: BIN Units: Byte Resolution: 1 Range: 0...65535	
5	Block Size LSB		
6	Maximum Block Separation Time MSB	Maximum Block Separation Time in milliseconds Bits: 16 Coding: BIN Units: Milliseconds Resolution: 1 Range: 0...65535	
7	Maximum Block Separation Time LSB		

**Table 3-28: Data Download Response Message #2**

Response code "-4 Invalid Data" will not be used.

Note: Data download via multicast (one to many) will not be supported by the MGCU.

**3.4.4.5 Data Download Acknowledge Response Message**

Message code is DT\_REQ. Data length code is 3.

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
0	Service Function Code MSB	0x00	
1	Service Function Code LSB	0x03	

<i>Byte</i>	<i>Data</i>	<i>Designation</i>	<i>Remarks</i>
2	Response Code	Bits: 8 Coding: BIN Range: -128...127 -1 = Checksum Error 1 = Checksum Okay	

Table 3-29: Data Download Acknowledge Response Message

### 3.4.5 Maintenance Peer to Peer Protocol

#### 3.4.5.1 Maintenance Peer to Peer Header

<i>Message Element</i>	<i>Message</i>	<i>Remarks</i>
LCC	4	NSC
Sender: FID	123	FID is123 (Galley Inserts)
SMT	0/1	Service Message Type is Receiver => Sender (Download) or Sender => Receiver (Upload)
LCL	1	local bus only
PVT	1	Opaque data
Receiver: FID	123	FID is123 (Galley Inserts)
Receiver: ID	1...127	Device identifier: 1...127
RCI	0	Redundancy Channel is 0

Table 3-30: Maintenance Peer-to-Peer Message Header

#### 3.4.5.2 Maintenance Peer to Peer Message Data

<i>Byte</i>	<i>Message</i>	<i>Remarks</i>
Byte #0	Sender: ID	
Byte #1	Payload byte #0...#7	Opaque Data
Byte #2		
Byte #3		
Byte #4		
Byte #5		
Byte #6		
Byte #7		

Table 3-31: Maintenance Peer-to-Peer Message Data

## 3.5 Bite (Diagnostics Functionality)

### 3.5.1 Overview

The MGCU must be capable of determining the nature of failures in the galley network group. This is accomplished via 2 mechanisms:

- The absence or presence of STA\_GAIN and STA\_MGCU messages. This is covered in the Network Monitoring section.

- Information provided by galley network members using the DIAG message

The mechanism for accomplishing the Diagnostics function is encapsulated into 3 separate messages. The DIAG message is an information delivery message that defines a detected error condition of a node. The DIAG\_CMD message is a mechanism for invocation of specific diagnostic commands in support of the A350 BITE functions, which is considered out of scope for the discussion of this document.

#### 3.5.1.1 Diagnostics Messages

There will be 3 Diagnostics messages (3 unique message identifiers) for all GAINs. These are:

- DIAG\_FAILURE, used to post failures
- DIAG\_MALFUNCTION, used to post malfunctions
- DIAG\_WARNING, used to post warnings.

#### NSD350-V-25-36-220

The following tables are defining the Diagnostics messages that shall be sent by any GAIN after receiving DIAG\_CMD from MGCU.

With respect to the noted Diagnostics messages, the following signal definitions shall apply:

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
DIAG_Warning_Pending	Bit	0: DIAG Warning not pending 1: DIAG Warning pending
DIAG_Malfunction_Pending	Bit	0: DIAG Malfunction not pending 1: DIAG Malfunction pending
DIAG_Failure_Pending	Bit	0: DIAG Failure not pending 1: DIAG Failure pending

**Table 3-32: DIAG Message**

#### NSD350-V-25-36-248

DIAG\_Warning\_Pending bit shall be set if at least one Warning indications in the payload of the DIAG\_WARNING message

#### NSD350-V-25-36-247

DIAG\_Multifunction\_Pending bit shall be set if at least one Malfunction indications in the payload of the DIAG\_MALFUNCTION message.

#### NSD350-V-25-36-250

DIAG\_Failure\_Pending bit shall be set if at least one Failure indications in the payload of the DIAG\_FAILURE message.

**NSD350-V-25-36-222**

The following DIAG\_FAILURE message signals shall be used:

Byte	Bit	Data	Designation
0	0	Reserved	0
	1	DIAG_Warning_Pending	0: DIAG Warning not pending 1: DIAG Warning pending
	2	DIAG_Malfunction_Pending	0: DIAG Malfunction not pending 1: DIAG Malfunction pending
	3	DIAG_Failure_Pending	0: DIAG Failure not pending 1: DIAG Failure pending
	4	Reserved	0
	5	Reserved	0
	6	Reserved	0
	7	Reserved	0
1	8	DIAG_General_Error_ID	Reserved 0
	9	DIAG_General_Error_ID	Hardware 0: no, 1: yes
	10	DIAG_General_Error_ID	Software 0: no, 1: yes
	11	DIAG_General_Error_ID	Operation 0: no, 1: yes
	12	DIAG_General_Error_ID	Interface 0: no, 1: yes
	13	DIAG_General_Error_ID	Communication 0: no, 1: yes
	14	DIAG_General_Error_ID	External Resources 0: no, 1: yes
	15	DIAG_General_Error_ID	Reserved 0
2	16	Checksum error	0: no, 1: yes
	17	Reserved	0
	18	Phase loss	0: no, 1: yes
	19	Phase A loss	0: no, 1: yes
	20	Phase B loss	0: no, 1: yes
	21	Phase C loss	0: no, 1: yes
	22	internal VDC device	0: no, 1: yes
	23	Fuse Phase A	0: no, 1: yes
3	24	Fuse Phase B	0: no, 1: yes
	25	Fuse Phase C	0: no, 1: yes
	26	Pin programming error feeder ID	0: no, 1: yes
	27	Pin programming error device ID	0: no, 1: yes
	28	Pin programming error Primary/Secondary	0: no, 1: yes
	29	Hardware	0: no, 1: yes
	30	Heater/Cooler 1	0: no, 1: yes
	31	Heater/Cooler 2	0: no, 1: yes
4	32	Heater/Cooler 3	0: no, 1: yes
	33	Heater/Cooler 4	0: no, 1: yes
	34	Pump/Motor 1	0: no, 1: yes
	35	Pump/Motor 2	0: no, 1: yes
	36	Valve 1/Sensor 1	0: no, 1: yes
	37	Valve 2/Sensor 2	0: no, 1: yes

	38	Valve 3/Sensor 3	0: no, 1: yes
	39	Burst disk	0: no, 1: yes
5	40	Warming Plate/Rotating plate(microwave)	0: no, 1: yes
	41	Fan1	0: no, 1: yes
	42	Fan2	0: no, 1: yes
	43	Display	0: no, 1: yes
	44	Over Pressure Device 2	0: no, 1: yes
	45	Overheat device 1	0: no, 1: yes
	46	Overheat device 2	0: no, 1: yes
	47	Overheat device 3	0: no, 1: yes
	6	48	Memory Read
49		Memory Write	0: no, 1: yes
50		Tank/Server water overflow	0: no, 1: yes
51		Low Pressure	0: no, 1: yes
52		Over Pressure	0: no, 1: yes
53		General Software Failure	0: no, 1: yes
54		Network Failure --> Unit InOp	0: no, 1: yes
55		Out of Service	0: no, 1: yes
7	56	Reserved	0
	57	Reserved	0
	58	Reserved	0
	59	Reserved	0
	60	Reserved	0
	61	Reserved	0
	62	Reserved	0
	63	Reserved	0

Table 3-33: DIAG Message Failure Coding

**NSD350-V-25-36-225**

The following DIAG\_MALFUNCTION message signals shall be used:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	Reserved	0
	1	DIAG_Warning_Pending	0: DIAG Warning not pending , 1: DIAG Warning pending
	2	DIAG_Malfunction_Pending	0: DIAG Malfunction not pending , 1: DIAG Malfunction pending
	3	DIAG_Failure_Pending	0: DIAG Failure not pending , 1: DIAG Failure pending

	4	Reserved	0
	5	Reserved	0
	6	Reserved	0
	7	Reserved	0
1	8	DIAG_General_Error_ID	Reserved 0
	9	DIAG_General_Error_ID	Hardware 0: no, 1: yes
	10	DIAG_General_Error_ID	Software 0: no, 1: yes
	11	DIAG_General_Error_ID	Operation 0: no, 1: yes
	12	DIAG_General_Error_ID	Interface 0: no, 1: yes
	13	DIAG_General_Error_ID	Communication 0: no, 1: yes
	14	DIAG_General_Error_ID	External Resources 0: no, 1: yes
	15	DIAG_General_Error_ID	Reserved 0
2	16	Data transmission error	0: no, 1: yes
	17	Command error	0: no, 1: yes
	18	Configuration error	0: no, 1: yes
	19	Power Factor Correction Device	0: no, 1: yes
	20	Over Pressure Device 1	0: no, 1: yes
	21	No Water	0: no, 1: yes
	22	Malfunction	0: no, 1: yes
	23	Reserved	0
3	24	Reserved	0
	25	Reserved	0
	26	Reserved	0
	27	Reserved	0
	28	Reserved	0
	29	Reserved	0
	30	Reserved	0
	31	Reserved	0
4	32	Reserved	0
	33	Reserved	0
	34	Reserved	0
	35	Reserved	0
	36	Reserved	0
	37	Reserved	0
	38	Reserved	0
	39	Reserved	0
5	40	Reserved	0
	41	Reserved	0
	42	Reserved	0
	43	Reserved	0
	44	Reserved	0
	45	Reserved	0
	46	Reserved	0

	47	Reserved	0
6	48	Reserved	0
	49	Reserved	0
	50	Reserved	0
	51	Reserved	0
	52	Reserved	0
	53	Reserved	0
	54	Reserved	0
	55	Reserved	0
7	56	Reserved	0
	57	Reserved	0
	58	Reserved	0
	59	Reserved	0
	60	Reserved	0
	61	Reserved	0
	62	Reserved	0
	63	Reserved	0

Table 3-34: DIAG Message with Malfunction Bit Coding

**NSD350-V-25-36-452**

The following DIAG\_WARNING message signals shall be used:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	Reserved	0
	1	DIAG_Warning_Pending	0: DIAG Warning not pending , 1: DIAG Warning pending
	2	DIAG_Malfunction_Pending	0: DIAG Malfunction not pending , 1: DIAG Malfunction pending
	3	DIAG_Failure_Pending	0: DIAG Failure not pending , 1: DIAG Failure pending
	4	Reserved	0
	5	Reserved	0
	6	Reserved	0
	7	Reserved	0
1	8	DIAG_General_Error_ID	Reserved   0
	9	DIAG_General_Error_ID	Hardware   0: no, 1: yes
	10	DIAG_General_Error_ID	Software   0: no, 1: yes
	11	DIAG_General_Error_ID	Operation   0: no, 1: yes
	12	DIAG_General_Error_ID	Interface   0: no, 1: yes
	13	DIAG_General_Error_ID	Communication   0: no, 1: yes
	14	DIAG_General_Error_ID	External Resources   0: no, 1: yes
	15	DIAG_General_Error_ID	Reserved   0
2	16	Catering Process Quality Damaged	0: no, 1: yes

	17	Maximal Catering Temperature not reached	0: no, 1: yes
	18	Maximal Catering Temperature exceeded	0: no, 1: yes
	19	Data transmission interrupted	0: no, 1: yes
	20	File already exists	0: no, 1: yes
	21	Server not inserted	0: no, 1: yes
	22	Server not locked	0: no, 1: yes
	23	Door open	0: no, 1: yes
3	24	Server full -> please empty server before next catering process	0: no, 1: yes
	25	Food or beverage not removed/door not opened after catering process finished	0: no, 1: yes
	26	Calcification	0: no, 1: yes
	27	Overheat	0: no, 1: yes
	28	Onboard Maintenance	0: no, 1: yes
	29	Invalid Device ID	0: no, 1: yes
	30	Allocation Exceeded	0: no, 1: yes
	31	Data Transfer Denied	0: no, 1: yes
4	32	Invalid Message	0: no, 1: yes
	33	Message Sequence Interrupted	0: no, 1: yes
	34	General Overflow	0: no, 1: yes
	35	General Overheat Device	0: no, 1: yes
	36	Maintenance	0: no, 1: yes
	37	General Temperature Fault	0: no, 1: yes
	38	Air Filter	0: no, 1: yes
	39	Reserved	0
5	40	Watchdog reset has occurred	0: no, 1: yes
	41	Power Interrupt > 200 ms, less than Resume Time (this is GAIN size dependent, since Power Interrupt Resume Times are GAIN size dependent)	0: no, 1: yes
	42	3-phase A/C Power Loss has occurred (power-down event)	0: no, 1: yes
	43	Reserved	0
	44	Reserved	0
	45	Reserved	0
	46	Reserved	0

	47	Reserved	0
6	48	Reserved	0
	49	Reserved	0
	50	Reserved	0
	51	Reserved	0
	52	Reserved	0
	53	Reserved	0
	54	Reserved	0
	55	Reserved	0
	7	56	Reserved
57		Reserved	0
58		Reserved	0
59		Reserved	0
60		Reserved	0
61		Reserved	0
62		Reserved	0
63		Reserved	0

**Table 3-35: DIAG Message with Warning Coding**

**NSD350-V-25-36-232**

Every GAIN shall send at least one DIAG\_FAILURE message reporting its status after the initial power on self-test is completed.

Comment: The GAIN may send additional DIAG\_WARNING or DIAG\_MALFUNCTION messages, but must send the DIAG\_FAILURE message.

**NSD350-V-25-36-235**

If a GAIN has no failures, warnings or malfunctions following a power on self-test, the GAIN shall send the DIAG\_FAILURE message with none of the bits set (e.g. all zeroes, indicating no problems).

**NSD350-V-25-36-234**

Every GAIN shall send its status within a Diagnostics message after reception of a DIAG\_CMD message from the MGCU.

**NSD350-V-25-36-233**

Every GAIN shall send its status within a Diagnostics message on event (meaning the GAIN has some sort of failure occurrence, and may send the message immediately).

**NSD350-V-25-36-231**

In case that the GAIN has an error with the error gravity classification "Failure", the GAIN shall transition to the 'Error' state.

**NSD350-V-25-36-230**

The definitions for Error Gravity, Specific Error ID and General ID shall be used from the Error Definition Matrix (NSD350-V-25-36-245). No other values shall be permitted.

**NSD350-V-25-36-236**

The MGCU shall be capable of receiving the DIAG message in all states except the 'Error' state.

**3.5.1.2 DIAG\_CMD (Diagnostics Command) Message**

**NSD350-V-25-36-238**

The content of the DIAG\_CMD message shall be as follows:

Byte	Bit	Data	Designation	Source of signal
0	0	DIAG_CMD_Command MSB	Bits: 8 Coding: BIN Units: - Resolution: 1 Range: 0-255 0: Not applicable signal Self test 1: Self test request 2: Reserved 3: Reserved GAIN Messages (not implemented) 4-255: Reserved	
0	1	DIAG_CMD_Command		
0	2	DIAG_CMD_Command		
0	3	DIAG_CMD_Command		
0	4	DIAG_CMD_Command		
0	5	DIAG_CMD_Command		
0	6	DIAG_CMD_Command		
0	7	DIAG_CMD_Command LSB		
1	8	Reserved	0	
1	9	Reserved	0	
1	10	Reserved	0	
1	11	Reserved	0	
1	12	Reserved	0	
1	13	Reserved	0	
1	14	Reserved	0	
1	15	Reserved	0	
2	16	Reserved	0	
2	17	Reserved	0	
2	18	Reserved	0	
2	19	Reserved	0	
2	20	Reserved	0	
2	21	Reserved	0	
2	22	Reserved	0	
2	23	Reserved	0	
3	24	Reserved	0	
3	25	Reserved	0	
3	26	Reserved	0	

3	27	Reserved	0	
3	28	Reserved	0	
3	29	Reserved	0	
3	30	Reserved	0	
3	31	Reserved	0	
4	32	Reserved	0	
4	33	Reserved	0	
4	34	Reserved	0	
4	35	Reserved	0	
4	36	Reserved	0	
4	37	Reserved	0	
4	38	Reserved	0	
4	39	Reserved	0	
5	40	Reserved	0	
5	41	Reserved	0	
5	42	Reserved	0	
5	43	Reserved	0	
5	44	Reserved	0	
5	45	Reserved	0	
5	46	Reserved	0	
5	47	Reserved	0	
6	48	Reserved	0	
6	49	Reserved	0	
6	50	Reserved	0	
6	51	Reserved	0	
6	52	Reserved	0	
6	53	Reserved	0	
6	54	Reserved	0	
6	55	Reserved	0	
7	56	Reserved	0	
7	57	Reserved	0	
7	58	Reserved	0	
7	59	Reserved	0	
7	60	Reserved	0	
7	61	Reserved	0	
7	62	Reserved	0	
7	63	Reserved	0	

Table 3-36: DIAG\_CMD Message Format

**NSD350-V-25-36-243**

The MGCU shall be able to send the DIAG\_CMD at any time, except when the MGCU is in the 'Initialization' and 'Error' state.

**NSD350-V-25-36-242**

The GAINs shall be capable of receiving and processing the DIAG\_CMD at any time, in any state, except the 'Initialization' state.

**NSD350-V-25-36-244**

According to the message content of byte 0, the GAIN shall start the initial power on self test upon request from the MGCU if it is in state Standby\_OFF, Standby\_ON or Error.  
GAIN shall return the result of a previous initial power on self test upon request from the MGCU otherwise.

**NSD350-V-25-36-816**

A DIAG\_CMD could function as a broadcast message. Then every GAIN should send the diagnostic status, when receiving a DIAG\_CMD with device\_id set to 0. The device\_id in the GAIN message shall be set equal to the pin programming.

**NSD350-V-25-36-453**

Only the following Error / Failure / Warning definitions shall be supported in A350 Galley Network:

**NSD350-V-25-36-245**

<i>Error/Failure</i>	<i>Error Gravity</i>	<i>General Error ID</i>	<i>information will displayed / send to</i>
Catering Process Quality Damaged	Warning	Operation	GAIN + MGCU
Maximal Catering Temperature not reached	Warning	Operation	GAIN + MGCU
Maximal Catering Temperature exceeded	Warning	Operation	GAIN + MGCU
Data transmission interrupted	Warning	Communication	GAIN + MGCU
Data transmission error	Malfunction	Communication	GAIN + MGCU
Allocation exceeded	Information	Communication	MGCU
File already exists	Warning	Communication	MGCU
Data transfer denied (already on process)	Information	Communication	MGCU
Checksum error	Failure	Hardware	MGCU
Invalid device ID	Warnung	Interface	MGCU
Invalid message	Information	Communication	GAIN + MGCU
Command error	Malfunction	Communication	MGCU
Message sequence interrupted	Information	Operation	MGCU
Overflow			GAIN + MGCU
Configuration error	Malfunction	Software	GAIN + MGCU
Phase loss	Failure	External resources	GAIN + MGCU
Phase A loss	Failure	Hardware	GAIN + MGCU
Phase B loss	Failure	Hardware	GAIN + MGCU
Phase C loss	Failure	Hardware	GAIN + MGCU
internal VDC device	Failure	Hardware	
Fuse Phase A	Failure	Hardware	GAIN + MGCU
Fuse Phase B	Failure	Hardware	GAIN + MGCU
Fuse Phase C	Failure	Hardware	GAIN + MGCU
Power loss < 200 ms			
Power loss >= 200 ms	Information	Hardware	GAIN
Pin programming error feeder ID	Failure	Interface	GAIN + MGCU
Pin programming error device ID	Failure	Interface	GAIN + MGCU
Pin programming error Primary/Secondary	Failure	Interface	GAIN + MGCU

Server not inserted	Warning	Operation	GAIN + MGPU
Server not locked	Warning	Operation	GAIN + MGPU
Door open	Warning	Operation	GAIN + MGPU
Server full -> please empty server before next catering process	Warning	Operation	GAIN + MGPU
Food or beverage not removed/door not opened after catering process finished	Warning	Operation	GAIN + MGPU
Hardware	Failure	Hardware	GAIN + MGPU
Heater/Cooler 1	Failure	Hardware	GAIN + MGPU
Heater/Cooler 2	Failure	Hardware	GAIN + MGPU
Heater/Cooler 3	Failure	Hardware	GAIN + MGPU
Heater/Cooler 4	Failure	Hardware	GAIN + MGPU
Pump/Motor 1	Failure	Hardware	GAIN + MGPU
Pump/Motor 2	Failure	Hardware	GAIN + MGPU
Valve 1/Sensor 1	Failure	Hardware	GAIN + MGPU
Valve 2/Sensor 2	Failure	Hardware	GAIN + MGPU
Valve 3/Sensor 3	Failure	Hardware	GAIN + MGPU
Burstdisk	Failure	Hardware	GAIN + MGPU
Warming Plate/Rotating plate(microwave)	Failure	Hardware	GAIN + MGPU
Fan1	Failure	Hardware	GAIN + MGPU
Fan2	Failure	Hardware	GAIN + MGPU
Display	Failure	Hardware	GAIN + MGPU
Power Factor Correction Device	Malfunction	Hardware	GAIN
Over Pressure Device 1	Malfunction	External resources	GAIN
Over Pressure Device 2	Failure	Hardware	GAIN + MGPU
Overheat device 1	Failure	Hardware	GAIN + MGPU
Overheat device 2	Failure	Hardware	GAIN + MGPU
Overheat device 3	Failure	Hardware	GAIN + MGPU
Overheat device	Information	Hardware	GAIN
Memory Read	Failure	Hardware	GAIN + MGPU
Memory Write	Failure	Hardware	GAIN + MGPU
No Water	Malfunction	Interface	GAIN + MGPU
Tank/Server water overflow	Failure	Hardware	GAIN + MGPU
Low Pressure	Failure	Hardware	GAIN + MGPU
Over Pressure	Failure	Hardware	GAIN + MGPU
Calcification	Warning	Operation	GAIN + MGPU
Overheat	Warning	Operation	GAIN + MGPU
Maintenance	Information	Hardware	MGPU
Malfunction	Malfunction	Operation	GAIN + MGPU
Temporary Fault	Information	Hardware	GAIN
Onboard Maintenance	Warning	Hardware	GAIN + MGPU
General Software Failure	Failure	Software	GAIN + MGPU
Network Failure --> Unit InOp	Failure	Communication	GAIN + MGPU
Air Filter	Information	Operation	
Out of Service	Failure	Hardware	GAIN + MGPU

Table 3-37: Error Definition Matrix

### 3.6 Power Control

Power Management functionality is based on a message concept which includes information about the individual power consumption of each GAIN. To enable this functionality, it is mandatory that each GAIN is able to communicate its power consumption depending on the state the GAIN operates in.

For the whole Power Management concept, 4 different power threshold budgets per GAIN are needed and shall be stored in the Configuration Data Block 3.

It is mandatory that each GAIN follows the given rules for using power budgets regarding the state of the GAIN and regarding the given priority (primary or secondary defined via PIN Programming).

#### 3.6.1 Definitions

<i>Item</i>	<i>Definition</i>
STANDBY_POWER_THRESHOLD	<p>The Standby Power Threshold is the power a GAIN always needs for a constant power supply e.g. for the micro controller.</p> <p>Power below this threshold is always allowed in any state and in any mode.</p> <p>The use of Standby Power is not dependent on the priority of the GAIN (for either Primary or Secondary GAINS).</p> <p>In the integrated Galley Network, this power budget is always considered granted and available..</p>
FALLBACK_POWER_THRESHOLD	<p>The Fallback Power Threshold is the power budget that a GAIN is allowed to consume as a primary GAIN type (depending on Pin Programming) in the case of no communication with the MGCU or associated Feeder for a GAIN is not in Centralized Power Control Mode ( called Fallback Mode )</p> <p>As a consequence, a Primary GAIN is allowed to use a Fallback Power Threshold which is equal to the Maximum Power Threshold.</p> <p>In the integrated Galley Network, the Fallback Power budget for all installed primary GAINS is always considered granted and available in Fallback Mode.</p>
MINIMUM_POWER_THRESHOLD	<p>The Minimum Power Threshold is the power a GAIN needs to start or to continue a catering process.</p> <p>This power budget reflects the lower level of the needed power for a catering cycle.</p> <p>Supplying the warmer plate e.g. for a coffee maker is expected with using Minimum Power Thresholds, but not the brewing cycle itself.</p> <p>Consuming Minimum Power is only allowed if the MGCU granted the power within a PBM message. The only exception could occur in Fallback Mode (primary GAINS only).</p>
MAXIMUM_POWER_THRESHOLD	<p>The Maximum Power Threshold is the power a GAIN needs to start or to continuing the catering process.</p> <p>This power budget should reflect the upper level of the needed power for a catering cycle.</p> <p>For all GAINS with partial power capabilities, the Maximum Power Threshold should be greater or equal to the Minimum Power Threshold.</p> <p>For all GAINS with no partial power capabilities it is assumed that the Maximum Power Threshold is equal to the Minimum</p>

<i>Item</i>	<i>Definition</i>
	Power Threshold. Consuming Maximum Power is only allowed if the MGCU granted the power within a PBM message. The only exception could occur in Fallback Mode (primary GAINs only).

**Table 3-38: Power Control Definitions**

### 3.6.2 Power Control Overview

The aim of a power arbitrating galley is for an MGCU with Power Control functionality to arbitrate power consumption of GAINs in a galley allocated to a galley power feeder. This arbitration schema is designed to prevent feeder overload conditions by imposing a cooperative control schema in a galley network group, and granting or denying permission to use power quantities that a GAIN is requesting. The mechanism for this cooperation schema is a collection of messages specifically designated for power control arbitration.

For the purposes of this discussion, the term MGCU\_PC is an MGCU that has Power Control arbitration functionality. Power control arbitration methods between a GAIN and an MGCU will be applied to power load requirements that exceed a defined GAIN power threshold (as defined by the value STANDBY\_POWER\_THRESHOLD). The interaction of this behavior will be defined in this section.

Basic power requirements for a GAIN, as defined by the STANDBY\_POWER\_THRESHOLD, may always be consumed by a GAIN for basic control and indication functions. Any power requirements beyond this basic guaranteed threshold will be arbitrated with the MGCU.

In all cases, power threshold information must always be transmitted to the MGCU when possible (e.g. when the MGCU is detected on the network).

### 3.6.3 A350XWB ARINC 812 Power Control

As documented in ARINC 812, Power Control functionality has 3 different embodiments:

- Centralized Power Control, whereby an MGCU\_PC will arbitrate power requests from the GAIN community on a galley feeder
- Decentralized Power Control, whereby no MGCU\_PC exists on the GDB, and as such, GAINs must calculate and arbitrate power budgets and requests amongst themselves
- Fallback (Standalone) Power Control, whereby a GAIN detects no MGCU\_PC or any other GAIN on the GDB network.

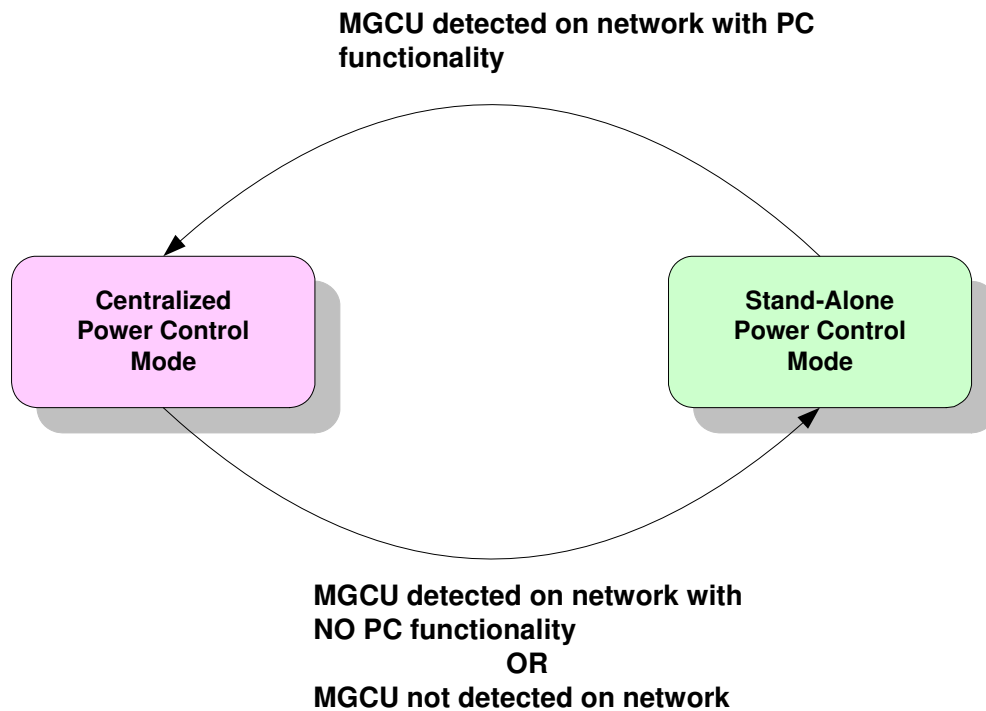
**NOTE: As determined by consensus for the A350XWB implementation of ARINC 812 Power Control, Decentralized Power Control functionality will NOT be implemented.**

On the A350 aircraft, there will be a maximum of 2 MGCUs on board. As such, an MGCU will utilize multiple power feeder networks. There will **not** be more than one Power Control Master (and MGCU that controls power arbitration messages) in the network group. As such, there will not be a Power Control Master arbitration schema employed between MGCUs, as noted in ARINC 812.

### 3.6.4 Power Control Implementation

For implementing Power Control Functionality, GAIN behavior will be determined by:

- Network architecture (e.g. the presence of an MGCU\_PC on the Galley Data Bus)
  - Individual GAIN power consumption requirements (e.g. GAIN catering behavior)
  - The discovered or determined Power Control mechanism (Centralized Fallback (Standalone) Power Control, as cited above)
  - The set of Power Control messages exchanged between a GAIN and an MGCU\_PC.
- The following figure defines the Power Control mode behavior of GAINs on the network.



**Figure 3-5: Power Control Mode**

According to the above figure, only two different communication architectures are possible. These are:

- Centralized Power Control
  - Fallback (Standalone) Power Control
- (These terms are synonymous and may be used interchangeably)

### 3.6.5 Centralized Power Control

Centralized Power Control is defined as follows:

- A MGCU with Power Control functionality (MGCU\_PC) is installed on the network, and is able to control and monitor GAINs.
- Any GAIN detecting an MGCU\_PC must change its mode to Centralized Power Control (based on moding rules).

Power Control consumption decisions are based on message exchanges between the MGCU\_PC and the GAIN.

#### **NSD350-V-25-36-617**

If a GAIN does not have Power Control functionality, it shall not operate in Centralized Power Control mode. It shall not respond to Power Control messages. It shall not produce any power control messages. It shall only operate in Fallback Power Control mode.

#### **NSD350-V-25-36-618**

Following initialization, when the MGCU is in the OPERATIONAL state, an MGCU with power control functionality shall set its power control functionality status bit (STA\_MGCU\_Implemented\_Functionalities, bit 1 set to 1).

#### **NSD350-V-25-36-619**

A MGCU\_PC (that, by definition is the power control master) shall memorize that functionality and provide power control arbitration in the power feeder group.

**NSD350-V-25-36-620**

A MGCU\_PC that detects any GAIN on the network that has power control functionality (defined by STA\_GAIN\_Implemented\_Functionalities, bit 1 set to 1), that MGCU shall send power control messages to those GAINs indicating power control functionality.

**NSD350-V-25-36-634**

A MGCU\_PC shall not send power control messages to any GAIN that does not indicate power control functionality.

**NSD350-V-25-36-621**

An MGCU without power control functionality shall not send power control messages to any GAIN, whether that GAIN has power control functionality or not.

**NSD350-V-25-36-622**

Power usage among the GAIN's in all power feeder groups shall be continuously monitored by the MGCU\_PC's Centralized Power Control Messages.

**3.6.5.1 Centralized Power Control Messages**

This section defines power control message exchanges for implementation of Centralized Power Control functionality.

<i>Message Name</i>	<i>Device</i>	
	<i>Send</i>	<i>Receive</i>
STA_GAIN	All GAINs	MGCU_PC
STA_MGCU	All MGCU_PC's	GAIN
GAIN_PT	GAIN	MGCU_PC
PBR	GAIN	MGCU_PC
PBM	MGCU_PC	GAIN

**Table 3-39: Power Control Messages**

**3.6.5.2 GAIN State Transitions for Centralized Power Control**

GAIN State Transitions for Centralized Power Control are indicated in section 4.

**3.6.5.2.1 GAIN\_PT (GAIN Power Threshold) Message**

A GAIN\_PT message is populated and sent by all GAINs.

Table below defines the message signals in the GAIN\_PT message.

<i>Signal Name</i>	<i>Comment</i>
GAIN_PT_Maximum_Power_Threshold	Max. power needed to continue catering process.
GAIN_PT_Fallback_Power_Threshold	Power consumption below this threshold is always allowed for a Primary GAIN type in Fallback Power Control mode.
GAIN_PT_Minimum_Power_Threshold	Minimum power needed to start/continue the catering process with no reduction in catering quality.
GAIN_PT_Standby_Power_Threshold	Power consumption below this threshold is always allowed in any state by any GAIN type (primary or

	secondary).
--	-------------

**Table 3-40: GAIN\_PT Message Signals****NSD350-V-25-36-635**

The following content and format of the GAIN\_PT message shall apply:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	GAIN_PT_Standby_Power_Threshold MSB	Bits: 8 Coding: BIN Units: VA Resolution: 5 Range: 5-1275 0: Not applicable
0	1	GAIN_PT_Standby_Power_Threshold	
0	2	GAIN_PT_Standby_Power_Threshold	
0	3	GAIN_PT_Standby_Power_Threshold	
0	4	GAIN_PT_Standby_Power_Threshold	
0	5	GAIN_PT_Standby_Power_Threshold	
0	6	GAIN_PT_Standby_Power_Threshold	
0	7	GAIN_PT_Standby_Power_Threshold LSB	
1	8	GAIN_PT_Maximum_Power_Threshold MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
1	9	GAIN_PT_Maximum_Power_Threshold	
1	10	GAIN_PT_Maximum_Power_Threshold	
1	11	GAIN_PT_Maximum_Power_Threshold	
1	12	GAIN_PT_Maximum_Power_Threshold	
1	13	GAIN_PT_Maximum_Power_Threshold	
1	14	GAIN_PT_Maximum_Power_Threshold	
1	15	GAIN_PT_Maximum_Power_Threshold LSB	
2	16	GAIN_PT_Minimum_Power_Threshold MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
2	17	GAIN_PT_Minimum_Power_Threshold	
2	18	GAIN_PT_Minimum_Power_Threshold	
2	19	GAIN_PT_Minimum_Power_Threshold	
2	20	GAIN_PT_Minimum_Power_Threshold	
2	21	GAIN_PT_Minimum_Power_Threshold	
2	22	GAIN_PT_Minimum_Power_Threshold	
2	23	GAIN_PT_Minimum_Power_Threshold LSB	
3	24	GAIN_PT_Fallback_Power_Threshold MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
3	25	GAIN_PT_Fallback_Power_Threshold	
3	26	GAIN_PT_Fallback_Power_Threshold	
3	27	GAIN_PT_Fallback_Power_Threshold	
3	28	GAIN_PT_Fallback_Power_Threshold	
3	29	GAIN_PT_Fallback_Power_Threshold	
3	30	GAIN_PT_Fallback_Power_Threshold	
3	31	GAIN_PT_Fallback_Power_Threshold LSB	
4	32	Reserved	0
4	33	Reserved	0
4	34	Reserved	0
4	35	Reserved	0
4	36	Reserved	0

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
4	37	Reserved	0
4	38	Reserved	0
4	39	Reserved	0
5	40	Reserved	0
5	41	Reserved	0
5	42	Reserved	0
5	43	Reserved	0
5	44	Reserved	0
5	45	Reserved	0
5	46	Reserved	0
5	47	Reserved	0
6	48	Reserved	0
6	49	Reserved	0
6	50	Reserved	0
6	51	Reserved	0
6	52	Reserved	0
6	53	Reserved	0
6	54	Reserved	0
6	55	Reserved	0
7	56	Reserved	0
7	57	Reserved	0
7	58	Reserved	0
7	59	Reserved	0
7	60	Reserved	0
7	61	Reserved	0
7	62	Reserved	0
7	63	Reserved	0

**Table 3-41: GAIN Power Thresholds Message Format**

The GAIN\_PT message must be sent when the GAIN recognizes and changes to Centralized Power Control mode.

**NSD350-V-25-36-639**

If the MGCU has been communicating on the bus and is determined to be present (by respecting the MGCU\_COUNTER\_THRESHOLD\_STA\_MGCU counter/timer values), the GAIN\_PT message shall be sent within 2 seconds after identifying that the MGCU is an MGCU\_PC.

**NSD350-V-25-36-640**

The GAIN\_PT parameters that the GAIN sends to the MGCU shall be identical to those in the GAIN's Configuration Data Block #3 (Power Thresholds).

**NSD350-V-25-36-642**

The MGCU shall memorize GAIN Power Threshold message data from each GAIN.

Comment: This data will be used to calculate power consumption requirements.

#### NSD350-V-25-36-644

For GAINs, the following relationships shall apply with respect to the GAIN\_PT field element values:

MAXIMUM\_POWER\_THRESHOLD >= FALLBACK\_POWER\_THRESHOLD >=

MINIMUM\_POWER\_THRESHOLD > STANDBY\_POWER\_THRESHOLD.

Each GAIN\_PT message shall have the following Power Control components:

<i>Item</i>	<i>Units</i>	<i>Definition</i>
Maximum_Power_Threshold	VA	The maximum power that a GAIN needs to start or continue its catering process. Example: Heating cold water to boiling.
Fallback_Power_Threshold	VA	The power that a GAIN is allowed to consume as a Primary GAIN type (as determined by Pin Programming)
Minimum_Power_Threshold	VA	The minimum power that a GAIN needs in order to start or continue its catering process. Example: Maintaining hot water that is already hot.
Standby_Power_Threshold	VA	The power that is allowed for a GAIN to consume in any mode or state, for either Primary or Secondary GAINs. This power shall always be considered as granted and available for the GAIN.

**Table 3-42: GAIN Power Thresholds Message Elements**

#### NSD350-V-25-36-647

##### Item **Maximum\_Power\_Threshold**

The maximum power that a GAIN needs to start or continue its catering process.

Example: Heating cold water to boiling.

#### NSD350-V-25-36-648

##### Item **Fallback\_Power\_Threshold**

The power that a GAIN is allowed to consume as a Primary GAIN type (as determined by Pin Programming).

#### NSD350-V-25-36-649

##### Item **Minimum\_Power\_Threshold**

The minimum power that a GAIN needs in order to start or continue its catering process.

Example: Maintaining hot water that is already hot.

#### NSD350-V-25-36-650

##### Item **Standby\_Power\_Threshold**

The power that is allowed for a GAIN to consume in any mode or state, for either Primary or Secondary GAINs.

This power shall always be considered as granted and available for the GAIN.

**3.6.5.2.2 PBR (Power Budget Request) Message**

A Power Budget Request (PBR) message is populated and sent by all GAINs prior to the start of a catering cycle, before power is to be consumed. Furthermore, this message provides the MGCU with all the needed power budget parameters to evaluate the GAIN's catering power needs with respect to the current power consumption on the power feeder that the requesting GAIN resides on.

**NSD350-V-25-36-653**

Each PBR shall be answered by MGCU via PBM.

**NSD350-V-25-36-654**

Each requested power budget from GAIN (PBR\_Nominal\_Power\_Budget or PBR\_Minimal\_Power\_Budget) shall be used for the associated answer from MGCU (PBM\_Power\_Budget\_Max), if the requested power is guaranteed. If the power is not guaranteed for a certain time the answer from MGCU (PBM\_Power\_Budget) shall be set to 0.

<i>Signal Name</i>	<i>Comment</i>
PBR_Power_Budget_Type	Catering process is "Interruptible" or not.
PBR_Nominal_Power_Budget	Power needed to start or continue catering.
PBR_Needed_Time_With_Nominal_PB	Required time with this Nominal Power Budget
PBR_Minimal_Power_Budget	Minimum power required to start or continue catering cycle with desired catering quality.
PBR_Needed_Time_With_Minimal_PB	Required time with this Minimal Power Budget

**Table 3-43: PBR Message Signals****NSD350-V-25-36-657**

The following content and format of the PBR message shall apply:

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
0	0	PBR_Power_Budget_Type	0: can be interrupted 1: can not be interrupted (default)
0	1	Reserved	0
0	2	Reserved	0
0	3	Reserved	0
0	4	Reserved	0
0	5	Reserved	0
0	6	Reserved	0
0	7	Reserved	0
1	8	PBR_Nominal_Power_Budget MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
1	9	PBR_Nominal_Power_Budget	
1	10	PBR_Nominal_Power_Budget	
1	11	PBR_Nominal_Power_Budget	
1	12	PBR_Nominal_Power_Budget	
1	13	PBR_Nominal_Power_Budget	
1	14	PBR_Nominal_Power_Budget	
1	15	PBR_Nominal_Power_Budget LSB	
2	16	PBR_Needed_Time_With_Nominal_PB MSB	Bits: 16 Coding: BIN
2	17	PBR_Needed_Time_With_Nominal_PB	

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
2	18	PBR_Needed_Time_With_Nominal_PB	Units: sec Resolution: 1 Range: 0: indefinite time 1-65535: defined time
2	19	PBR_Needed_Time_With_Nominal_PB	
2	20	PBR_Needed_Time_With_Nominal_PB	
2	21	PBR_Needed_Time_With_Nominal_PB	
2	22	PBR_Needed_Time_With_Nominal_PB	
2	23	PBR_Needed_Time_With_Nominal_PB	
3	24	PBR_Needed_Time_With_Nominal_PB	
3	25	PBR_Needed_Time_With_Nominal_PB	
3	26	PBR_Needed_Time_With_Nominal_PB	
3	27	PBR_Needed_Time_With_Nominal_PB	
3	28	PBR_Needed_Time_With_Nominal_PB	
3	29	PBR_Needed_Time_With_Nominal_PB	
3	30	PBR_Needed_Time_With_Nominal_PB	
3	31	PBR_Needed_Time_With_Nominal_PB LSB	
4	32	PBR_Minimal_Power_Budget MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0: Not applicable
4	33	PBR_Minimal_Power_Budget	
4	34	PBR_Minimal_Power_Budget	
4	35	PBR_Minimal_Power_Budget	
4	36	PBR_Minimal_Power_Budget	
4	37	PBR_Minimal_Power_Budget	
4	38	PBR_Minimal_Power_Budget	
4	39	PBR_Minimal_Power_Budget LSB	
5	40	PBR_Needed_Time_With_Minimal_PB MSB	Bits: 16 Coding: BIN Units: sec Resolution: 1 Range: 0: indefinite time 1-65535: defined time
5	41	PBR_Needed_Time_With_Minimal_PB	
5	42	PBR_Needed_Time_With_Minimal_PB	
5	43	PBR_Needed_Time_With_Minimal_PB	
5	44	PBR_Needed_Time_With_Minimal_PB	
5	45	PBR_Needed_Time_With_Minimal_PB	
5	46	PBR_Needed_Time_With_Minimal_PB	
5	47	PBR_Needed_Time_With_Minimal_PB	
6	48	PBR_Needed_Time_With_Minimal_PB	
6	49	PBR_Needed_Time_With_Minimal_PB	
6	50	PBR_Needed_Time_With_Minimal_PB	
6	51	PBR_Needed_Time_With_Minimal_PB	
6	52	PBR_Needed_Time_With_Minimal_PB	
6	53	PBR_Needed_Time_With_Minimal_PB	
6	54	PBR_Needed_Time_With_Minimal_PB	
6	55	PBR_Needed_Time_With_Minimal_PB LSB	
7	56	Reserved	0
7	57	Reserved	0
7	58	Reserved	0
7	59	Reserved	0
7	60	Reserved	0
7	61	Reserved	0
7	62	Reserved	0
7	63	Reserved	0

Table 3-44: Power Budget Request Message Format

The PBR message is only be sent by a GAIN that is in Power Control Mode. PBR messages must only be sent in accordance with the messages shown in the State Transition Diagrams, described in section 4.

**NSD350-V-25-36-661**

A PBR message shall be sent from the transition from the GAIN 'Standby ON' state to the GAIN 'Interrupted' state when a catering cycle is initiated.

**NSD350-V-25-36-662**

A PBR message shall be sent from the transition from the GAIN 'ON' state to the GAIN 'Waiting' state when a catering cycle is requested to be extended.

**NSD350-V-25-36-663**

If a GAIN has had its PBR denied by a PBM message from the MGCU, the PBM message contains a time value (PBM\_Time element) indicating the time that the GAIN is intended to wait before power is granted. In this condition, the GAIN shall initiate an internal timer that counts down from the PBM\_Time value.

Comment: A GAIN may wish to display a message to the operator indicating that it is blocked for at least PBM\_Time seconds and cannot continue.

**NSD350-V-25-36-665**

If or when the internal PBM\_Time value counts down to 0 (zero), the GAIN shall send a new PBR message to the MGCU.

**NSD350-V-25-36-666**

When the GAIN is in the 'ON' state and the GAIN no longer requires all of the catering power that it was granted with a previous PBM message, the GAIN shall stay in 'ON' state and transmit via STA\_GAIN the updated STA\_GAIN\_Used\_Power\_Budget. The GAIN shall send a new STA\_GAIN message on event when the used power budget changes.

Note: The MGCU will use the GAIN's STA\_GAIN\_Used\_Power\_Budget value to indicate that the GAIN no longer requires the power that it was using.

**NSD350-V-25-36-668**

When a primary GAIN is in Fallback Power Control mode, and is in the middle of a catering cycle when a mode change to Centralized Power Control occurs, the GAIN shall continue its catering cycle.

**NSD350-V-25-36-669**

If a GAIN sends a PBR message and the MGCU does not respond with a PBM within two received life pulse messages (STA\_MGCU) of the MGCU\_PC, the GAIN shall resend the PBR.

**3.6.5.2.3 PBM (Power Budget Maximum) Message**

A Power Budget Maximum (PBM) message is sent by the MGCU\_PC following a GAIN's request for power (from the PBR message), and processed by all GAIN\_PC's. This power budget is a power level granted by the MGCU\_PC that the GAIN is not allowed to exceed. The following table defines the PBM message signal elements.

<i>Signal Name</i>	<i>Comment</i>
PBM_Power_Budget_Max	The maximum amount of power that a GAIN may consume.

	<p>If this value is 0, the GAIN has been denied power and may not consume more than STANDBY_POWER_THRESHOLD. If this value is non-zero, the GAIN may not consume more power than this value.</p>
PBM_Time	<p>If power has been denied (PBM_Power_Budget_Max = 0), this values represents the time at which power may be available. The GAIN must use an internal timer to count this value down in seconds, and send a new PBR upon timer expiration.</p> <p>If power has been granted (PBM_Power_Budget_Max is non-zero), this message element is a don't care value (and as such, does not require evaluation by the receiving GAIN).</p>

**Table 3-45: PBM Message Signals**

**NSD350-V-25-36-680**

The following content and format of the PBM message shall apply:

Byte	Bit	Data	Designation
0	0	PBM_Power_Budget_Max MSB	Bits: 8 Coding: BIN Units: VA Resolution: 50 Range: 50-12750 0 = GAIN shall consume no more than STANDBY_POWER_THRESHOLD power Non-zero: Units VA
0	1	PBM_Power_Budget_Max	
0	2	PBM_Power_Budget_Max	
0	3	PBM_Power_Budget_Max	
0	4	PBM_Power_Budget_Max	
0	5	PBM_Power_Budget_Max	
0	6	PBM_Power_Budget_Max	
0	7	PBM_Power_Budget_Max LSB	
1	8	PBM_Time MSB	Bits: 16 Coding: BIN Units: sec Resolution: 1 Range: 0: Not applicable signal 1-65535: defined delay time
1	9	PBM_Time	
1	10	PBM_Time	
1	11	PBM_Time	
1	12	PBM_Time	
1	13	PBM_Time	
1	14	PBM_Time	
1	15	PBM_Time	
2	16	PBM_Time	
2	17	PBM_Time	
2	18	PBM_Time	
2	19	PBM_Time	
2	20	PBM_Time	
2	21	PBM_Time	
2	22	PBM_Time	
2	23	PBM_Time LSB	
3	24	Reserved	0
3	25	Reserved	0
3	26	Reserved	0
3	27	Reserved	0
3	28	Reserved	0
3	29	Reserved	0
3	30	Reserved	0

<i>Byte</i>	<i>Bit</i>	<i>Data</i>	<i>Designation</i>
3	31	Reserved	0
4	32	Reserved	0
4	33	Reserved	0
4	34	Reserved	0
4	35	Reserved	0
4	36	Reserved	0
4	37	Reserved	0
4	38	Reserved	0
4	39	Reserved	0
5	40	Reserved	0
5	41	Reserved	0
5	42	Reserved	0
5	43	Reserved	0
5	44	Reserved	0
5	45	Reserved	0
5	46	Reserved	0
5	47	Reserved	0
6	48	Reserved	0
6	49	Reserved	0
6	50	Reserved	0
6	51	Reserved	0
6	52	Reserved	0
6	53	Reserved	0
6	54	Reserved	0
6	55	Reserved	0
7	56	Reserved	0
7	57	Reserved	0
7	58	Reserved	0
7	59	Reserved	0
7	60	Reserved	0
7	61	Reserved	0
7	62	Reserved	0
7	63	Reserved	0

**Table 3-46: Power Budget Maximum Message Format**

In all instances below, a GAIN reports its power consumption (e.g. “claims” its granted power consumption) by posting the power consumption value in the STA\_GAIN\_Used\_Power\_Budget message element.

In all instances below, a “Catering Cycle” is defined as the following collection of GAIN states:

- ♣ ‘ON’
- ♣ ‘Stopped / Aborted’
- ♣ ‘Interrupted’
- ♣ ‘Waiting’

**NSD350-V-25-36-685**

The PBM message shall be monitored by GAINS with Power Control functionality, and rejected by GAINS with no power control functionality.

**NSD350-V-25-36-686**

When a GAIN receives a PBM message following the GAIN's PBR message, the GAIN shall indicate on event, state transitions from "Interrupted"- to "On"-state, that the granted power is used.

Comment: Failure to report usage of the granted power may result in the power being reclaimed by the MGCU.

**NSD350-V-25-36-690**

If a new PBM message is received that contains a PBM\_Max value of 0 (thus denying all power beyond Standby Power), if the GAIN is in a Catering Cycle state (defined above in this section), the GAIN shall stop using all formerly requested power within 3 seconds. The GAIN shall, at that time, revert to using its STANDBY\_POWER\_THRESHOLD, and transition to the 'Interrupted' state. The GAIN shall send a new PBR in this 'Interrupted' state.

Note: The "PBM 0" message is intended as a stop gap solution only, and will therefore be broadcast to all GAINs on a galley power feeder.

**NSD350-V-25-36-692**

If a GAIN receives a new PBM message prior to the GAIN's internal PBM\_Time timer expiring, the GAIN shall update (or restart) its internal PBM\_Time timer with the new PBM\_Time from the new PBM message.

Comment: This will resynchronize the GAIN's internal timer, and guarantees that the GAIN can handle consecutive PBM messages.

**NSD350-V-25-36-694**

A GAIN that requires its catering cycle to be extended beyond its initial time request shall enter the 'Waiting' state while holding power (e.g. maintaining current power consumption level, as reported by STA\_GAIN\_Power\_Used message element).

Each PBM message shall have the following Power Control components:

<i>Component</i>	<i>Units</i>	<i>Description / Usage</i>
Power_Budget_Max	VA	This shall indicate the maximum power consumption that the GAIN can consume. The GAIN may use this power budget until a new lower Power_Budget_Max is received. Power_Budget_Max shall never exceed a GAIN's Nominal_Power_Budget. Power_Budget_Max shall never be less than a GAIN's Minimal_Power_Budget When a GAIN's PBR message has been denied, Power_Budget_Max shall be 0.
Time	Seconds	If a PBR has been denied, this value shall represent the maximum time that no power will be granted to the GAIN. At the expiration of this timer (e.g. Time = 0), the GAIN shall send a new PBR message.

**Table 3-47: Power Budget Maximum Message Elements**

**NSD350-V-25-36-697**

Component **Power\_Budget\_Max**

This shall indicate the maximum power consumption that the GAIN can consume. The GAIN may use this power budget until a new lower Power\_Budget\_Max is received. When PBM\_Power\_Budget\_Max message element is non-zero (meaning that power has been granted), the PBM\_Time message element shall be zero.

**NSD350-V-25-36-699**

Component **Power\_Budget\_Max**

Power\_Budget\_Max shall never exceed a GAIN's Nominal\_Power\_Budget.

**NSD350-V-25-36-700**

Component **Power\_Budget\_Max**

Power\_Budget\_Max shall never be less than a GAIN's Minimal\_Power\_Budget

**NSD350-V-25-36-701**

Component **Power\_Budget\_Max**

When a GAIN's PBR message has been denied, Power\_Budget\_Max shall be 0.

**NSD350-V-25-36-702**

Component **Time**

If a PBR has been denied, this value shall represent the time that no power will be granted to the GAIN.

**NSD350-V-25-36-703**

Component **Time**

At the expiration of this timer (e.g. Time = 0), the GAIN shall send a new PBR message.

**3.6.6 Fallback Power Control**

Fallback (Standalone) Power Control mode behavior is defined below.

**NSD350-V-25-36-705**

A GAIN shall enter Fallback Power Control mode when an MGCU is not communicating on the network

**NSD350-V-25-36-706**

A GAIN shall enter Fallback Power Control mode when an MGCU is installed on the network and detected by GAINs, but the MGCU does not have Power Control functionality (e.g. the MGCU is not an MGCU\_PC device).

NOTE: When a GAIN is operating on a bench top or in a repair or test depot and not connected to a network, the GAIN will operate in Fallback Power Control (and is truly acting standalone).

**3.6.6.1 Fallback Power Control Messages**

This section defines message exchanges for implementation of Fallback Power Control functionality.

<i>Message Name</i>	<i>Device</i>	
	<i>Send</i>	<i>Receive</i>

STA_GAIN	All GAINs	MGCU
STA_MGCU	All MGCU_PCs	GAIN

**Table 3-48: Fallback Power Control Messages**

See section 4 for Fallback Power Control state transition details.

Comment: Note that with Fallback Power Control, the states 'Interrupted' and 'Waiting' are not present.

**NSD350-V-25-36-714**

A Primary GAIN (as indicated by Pin Programming discrete inputs) shall be allowed to use FALLBACK\_POWER\_THRESHOLD at any time in Fallback Power Control mode.

**NSD350-V-25-36-715**

A Secondary GAIN (as indicated by Pin Programming discrete inputs) shall be allowed to use STANDBY\_POWER\_THRESHOLD only in Fallback Power Control mode.

### 3.7 Power Interrupt Resume Function

The "Resume Catering" function is defined as the capability of a GAIN resuming a "Catering Cycle" state (as defined in section INSERT CATERING CYCLE DEFINITION SECTION HERE, which is put in Power Control) following power interrupts of durations that are longer than 200 ms and shorter than the times listed below in Table "Power Interrupt Resume Time"

<i>ARINC GAIN Size</i>	<i>Power Interrupt GAIN Resume Time Limit</i>
1	5
2	120
3	5
4	30
5	5

**Table 3-49: Power Interrupt Resume Table /s**

As noted, Power Interrupt Resume Times have been categorized by ARINC GAIN Size.

**NSD350-V-25-36-720**

For power interrupts greater than 200 ms and less than the Power Interrupt Resumption Time limit shown in Table "Power Interrupt Resume Time", the GAIN shall resume the Catering Cycle state that it was in when the power interrupt occurred.

Comment: The Resume Function allows the GAIN to use the power granted to it prior to the power interrupt, without the penalty of restarting the PBR/PBM cycle.

**NSD350-V-25-36-722**

For power interrupts greater than the Power Interrupt GAIN Resume Time Limit, the GAIN shall perform normal power up initialization activities, e.g. Power Up Self-Test functions, respecting normal power arbitration rules.

### 3.7.1 Pin Programming and Power Interrupt

#### NSD350-V-25-36-726

The following Table "Pin Programming Connector Definition" shall define the meaning of the pin programming:

<i>Pin Num</i>	<i>Name</i>	<i>Bit Priority</i>	<i>Designation</i>	<i>Remark</i>
1	DC Ground		DC Ground reference	Necessary for pin programming and other GND/open signals DC ground shall be provided by GAIN
2	Pin Programming		GND = Secondary Open = Primary	In case of "No bus communication" only baseline equipment can be switched on
3	Reserved			
4	Pin Programming	MSB	Feeder ID (0-31)	Maximum of 32 galley power feeder per aircraft
5	Pin Programming		Feeder ID	
6	Pin Programming			
7	Pin Programming			
8	Pin Programming	LSB	Feeder ID	
9	Pin Programming	MSB	(0-127) Device No. Device ID	Maximum of 128 devices per galley power feeder
10	Pin Programming			
11	Pin Programming			
12	Pin Programming			
13	Pin Programming			
14	Pin Programming		Even parity	To eliminate single point failures in configuration Even parity = 0 Odd parity = 1  The parity check shall include all Pin Programming pins, from 2 thru 20.
15	Pin			

<i>Pin Num</i>	<i>Name</i>	<i>Bit Priority</i>	<i>Designation</i>	<i>Remark</i>
	Programming			
16	Pin Programming	LSB	Device ID	
17	Reserved			
18	Reserved			
19	Reserved			
20	Pin Programming		Workshop mode	GND = Workshop mode Open = normal operation

**NSD350-V-25-36-818**

All reserved pins shall be logic 0 (false, non-active).

**NSD350-V-25-36-819**

The parity check shall include all Pin Programming pins, from 2 thru 20.

**Table 3-50: Pin Programming Connector Definition**

**NSD350-V-25-36-729**

A GAIN shall memorize in NVM the last valid pin programming Device ID as the Nvm\_Last\_Known\_Valid\_Device\_ID. This shall occur when the GAIN determines that there is no pin programming parity error.

Comment: Usually performed during Power Up Self-Test.

**NSD350-V-25-36-731**

A GAIN shall memorize in NVM the last valid pin programming Feeder ID as the Nvm\_Last\_Known\_Valid\_Feeder\_ID. This shall occur when the GAIN determines that there is no pin programming parity error.

Comment: Usually performed during Power Up Self-Test.

**NSD350-V-25-36-733**

A GAIN shall memorize in NVM the last valid Primary/Secondary ID as the Nvm\_Last\_Known\_Valid\_Pri\_Sec. This shall occur when the GAIN determines that there is no pin programming parity error.

Comment: Usually performed during Power Up Self-Test.

**NSD350-V-25-36-735**

For power interrupts longer than 200 ms and shorter than a GAIN's Power Resume Time (see section INSERT\_POWER\_RESUME\_SECTION\_HERE), the GAIN shall not read any of its pin programming discretes. The GAIN shall use the following values:

- Nvm\_Last\_Known\_Valid\_Device\_ID
- Nvm\_Last\_Known\_Valid\_Feeder\_ID
- Nvm\_Last\_Known\_Valid\_Pri\_Sec

**NSD350-V-25-36-815**

If a GAIN reads from its pin programming a device ID of 0, it shall send a DIAG\_WARNING message with warning "Invalid Device ID".

**3.7.1.1 Power Interrupt longer than 200 ms and shorter or equal than GAIN's Power Resume Time**

**NSD350-V-25-36-737**

The following requirements apply for power interrupts longer than 200 ms and shorter or equal than a GAIN's Power Resume Time (e.g. long power interrupt restart condition). For this condition, a GAIN must read its pin programming discretetes newly, and compare these new pin programming values with the last known values from NVM and report the type of error, noted below.

**NSD350-V-25-36-738**

If there is a pin programming parity error and the newly read pin programming Device ID is different from Nvm\_Last\_Known\_Valid\_Device\_ID, the GAIN shall send not a DIAG\_FAILURE message to the MGCU.

**NSD350-V-25-36-739**

If there is a pin programming parity error and the newly read pin programming Feeder ID is different from Nvm\_Last\_Known\_Valid\_Feeder\_ID, the GAIN shall send a DIAG\_FAILURE message to the MGCU with the failure code Pin Programming Error Feeder ID.

**NSD350-V-25-36-740**

If there is a pin programming parity error and the newly read pin programming Primary/Secondary is different than Nvm\_Last\_Known\_Valid\_Pri\_Sec, the GAIN shall send a DIAG\_FAILURE message to the MGCU with the failure code Pin Programming Error Primary/Secondary.

**3.7.1.2 Power Interrupt longer than GAIN's Power Resume Time**

The following requirements apply to the condition that the GAIN had a power interrupt longer than the GAIN's Power Resume Time.

**NSD350-V-25-36-743**

If a GAIN detects a pin programming error, and the NVM\_Last\_Know\_Valid\_Device\_ID is different than the newly read pin programming Device ID, the Device ID in the ARINC 825 Identifier shall be set to 0 (the default Device ID).

**NSD350-V-25-36-745**

The GAIN shall invalidate the contents of the Nvm\_Last\_Known\_Valid\_Device\_ID data element.

**NSD350-V-25-36-746**

The GAIN shall invalidate the contents of the Nvm\_Last\_Known\_Valid\_Feeder\_ID data element.

**NSD350-V-25-36-747**

The GAIN shall invalidate the contents of the Nvm\_Last\_Known\_Valid\_Pri\_Sec data element.

Comment: In this case, the GAIN shall not distinguish between the Device ID, Feeder ID, or Primary/Secondary pin programming errors.

**NSD350-V-25-36-750**

The GAIN shall continue to periodically transmit its STA\_GAIN message on the Default Device ID.

## 4 State Transitions

General GAIN behavior for 'Error' state and 'Standby Off' state:

NSD350-V-25-36-753

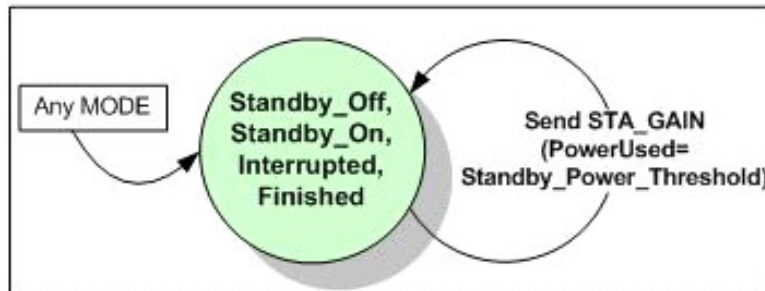
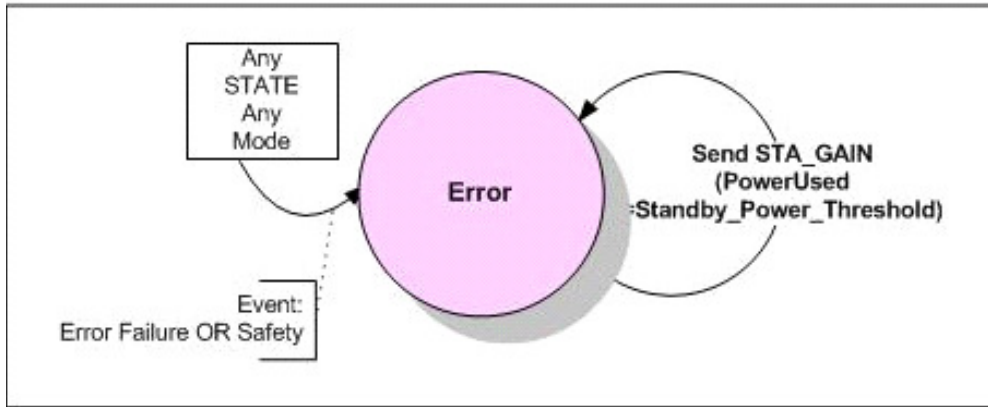


Figure 4-1: State Transitions, General GAIN Behavior

are  
GAIN diagnostic function general behavior:

NSD350-V-25-36-756

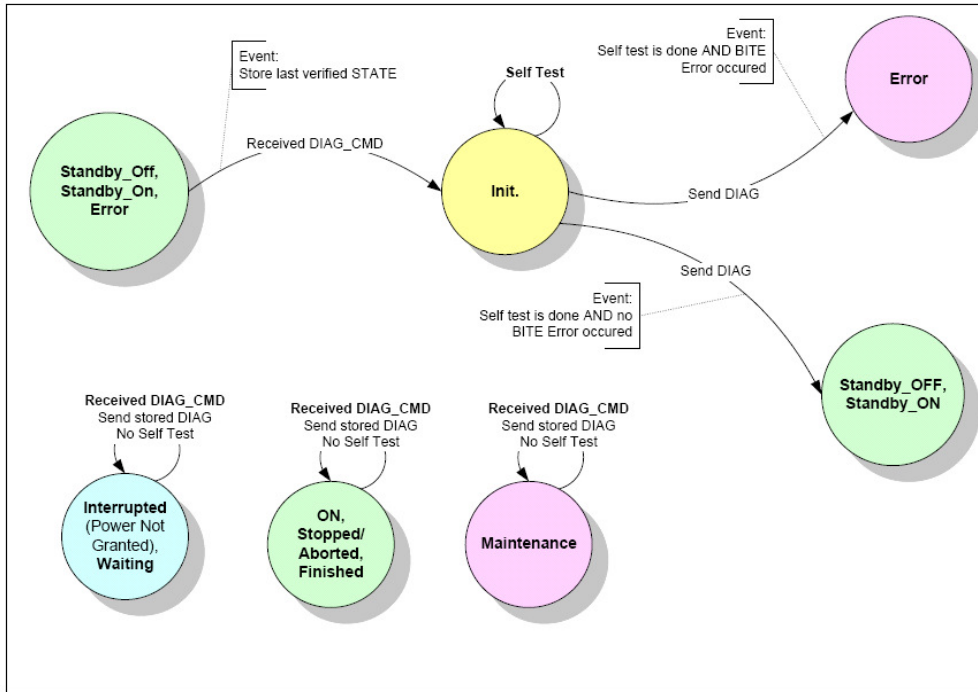
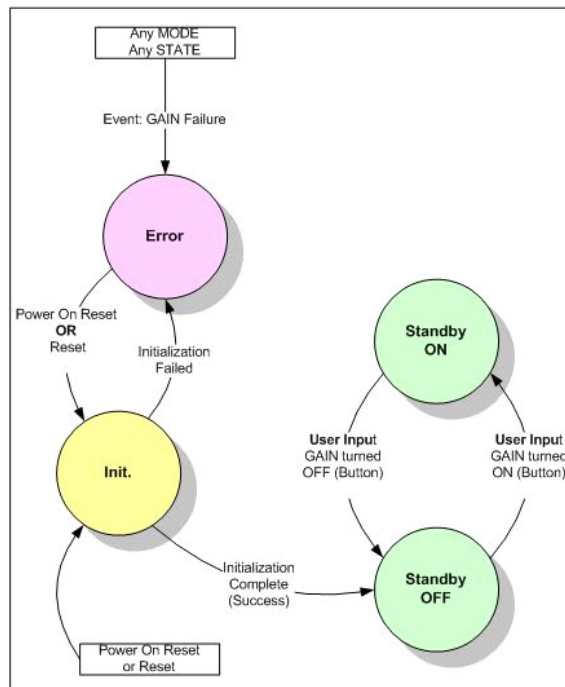


Figure 4-2: Diagnostics State Transitions

Secondary GAIN Fallback Power Control Mode general behavior:

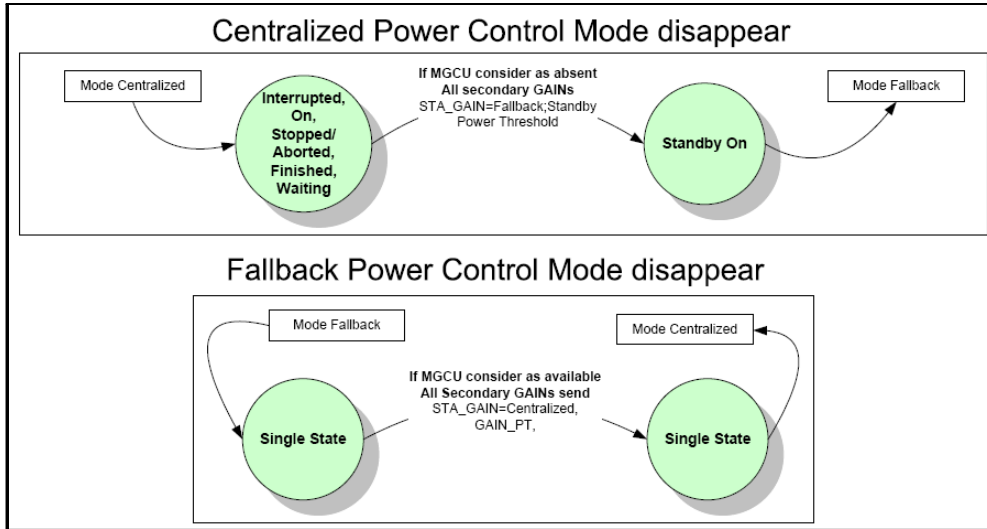
NSD350-V-25-36-759



**Figure 4-3: Fallback Power Control State Transition**

Secondary GAIN Fallback Power Control Mode appearance/disappearance:

**NSD350-V-25-36-762**



**Figure 4-4: Secondary GAIN Fallback State Transitions**

Primary GAIN Fallback Power Control Mode general behavior:

NSD350-V-25-36-765

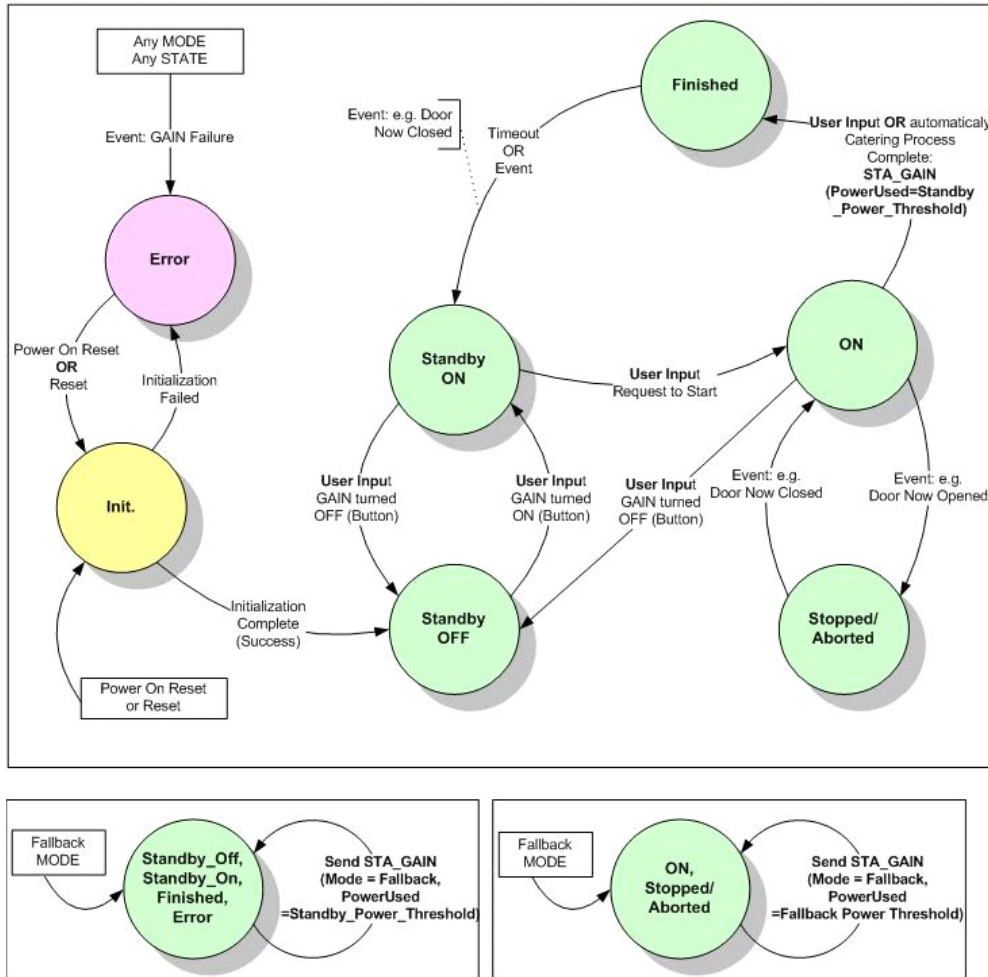
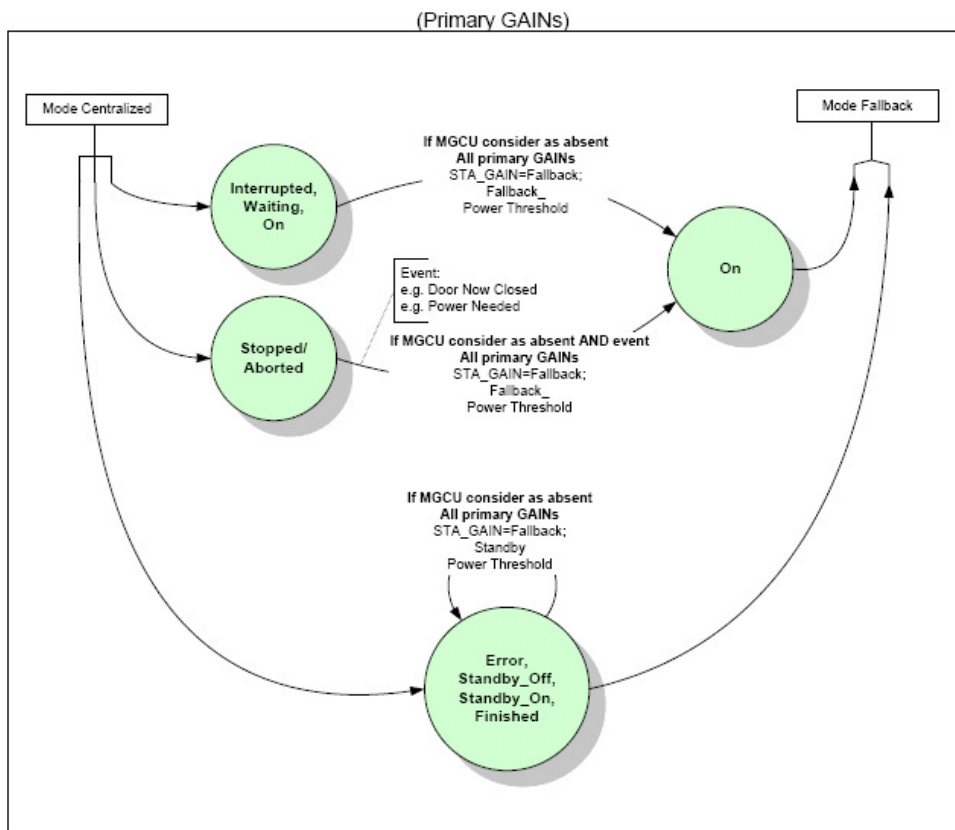


Figure 4-5: Primary GAIN Fallback PC State Transitions

Primary GAIN Fallback Power Control Mode appearance/disappearance

NSD350-V-25-36-768

Centralized Power Control Mode disappear



Fallback Power Control Mode disappear

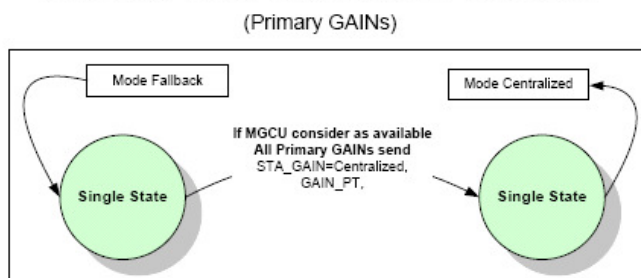


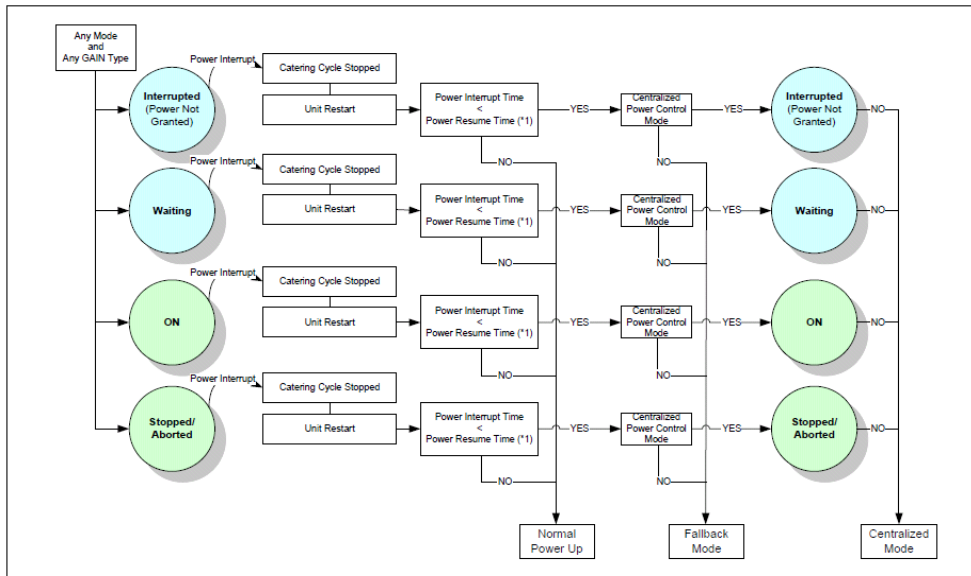
Figure 4-6: Primary GAIN Fallback PC State Transitions

GAIN Centralized Power Control Mode general behavior:



GAIN power interrupt resume function:

NSD350-V-25-36-774



\*1) Power Resume Time is defined in NSD Part 2 chapter 3.7 POWER INTERRUPT RESUME FUNCTION

Figure 4-8: Power Interrupt State Transitions

MGCU general behavior:

NSD350-V-25-36-780

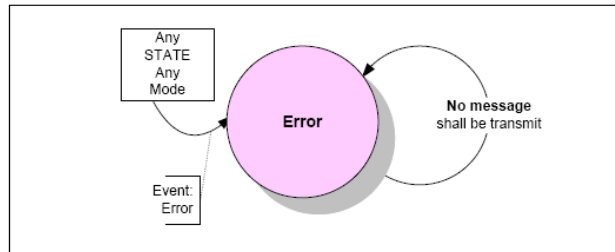


Figure 4-9: General MGCU Behavior