

IRS MIU-PSU

IS.EL.ENG.CondorMS

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Interface Requirements Specification (IRS)

for the
PSU – MIU Communication Interface

for the
Condor-MS System

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Prepared by :

EO-ISTAR Business Unit
ELBIT Systems Electro-Optics - Elop, Ltd.
PO Box 1165, Rehovot 76111, Israel

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Paragraph	Change Description	Reason of Change

List of TBDs

Reference	Description

List of TBRs

Reference	Description

List of TBCs

Reference	Description

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1 SCOPE

This document specifies the format and content of the communication messages between the MIU and the PSU.

1.1 Interface Overview

The PSU shall have a 100MbEth interface with which communication is accomplished with the MIU (performed using MDC - Management and Display Card of the MIU). The same interface shall also be used for downloading PSU logfile via the MIU Ethernet switch directly to external computer.

1.2 Document Overview

The document structure is as follows:

- Chapter 1 – Scope
- Chapter 2 – Applicable documents
- Chapter 3 – General Interface Protocol
- Chapter 4 – MIU to PSU Messages
- Chapter 5 – PSU to MIU Messages
- Chapter 6 - PSU Logfile Structure

1.3 Abbreviations and Acronyms

AC-	Alternating Current
A/C-	Aircraft
ADLS-	Airborne Data Link System
ATP-	Automatic Test Procedure
AUF-	Airborne Uninhibited Fighter
BIT-	Built In Test
BP-	Best Practice
BTOK-	Bench Test OK
CBIT-	Continuous Built-In-Test
CCTCU-	Camera Compartment Temperature Control Unit
CE-	Conducted Emission
C.M.-	Common Mode
CND-	Can Not Duplicate
COG-	Center Of Gravity
COTS-	Commercial Of The Shelf

CS-	Conducted Susceptibility
CSM-	Common Sensor Model
CT-	Corrective Time
CPLD-	Complex Programmable Logic Device
CPU-	central processing unit
DC-	Direct Current
D.M.-	Differential Mode
DRPU-	Dual Receiver Processor Unit
ECS-	Environment Control System
ECTCU-	Electronics Compartment Temperature Control Unit
EDU-	Encryption Decryption System
EI-	Electrical Interface
EMC-	Electro-Magnetic Compatibility
EMI-	Electro-Magnetic Interference
ER-	Established Reliability
ESS-	Environmental Stress Screening
ETI-	Elapsed Time Indication
ETM-	Elapsed Time Meter
EVT-	Environmental Verification Test
FAI-	First Article Inspection
FDU-	Filter & Distribution Unit
FIL-	Filtered
FFI-	For Future Implementation
FPGA-	Field Programmable Gate Array
FPS-	Frames Per Second
F/W-	Firmware
H/W-	Hardware
IBIT-	Initiated Built-In-Test
ICD-	Interface Control Document
ID-	Identification
I/F-	Interface
ILCTE-	Intermediate Level Computerized Test Equipment
ILS-	Integrated Logistic Support
INS-	Inertial Navigation System

LRU-	Line Replaceable Unit
MDC-	Management and Display Card
MIU-	Mission management & Image processing Unit
MS-	Multi-Spectral
MTBCF-	Mean Time Between Critical Failures
MTBF-	Mean Time Between Failures
MTBMA-	Mean Time Between Maintenance Action
MTO-	Military Temperature Only
MTTR-	Mean Time To Replace
NA-	Not Applicable
NATO-	North Atlantic Treaty Organization
OLTE-	Operational Level Test Equipment
O.V.-	Over Voltage
PBIT-	Periodic Built In Test
PCB-	Printed Circuit Board
POD-	Proof Of Design
PSD-	Power Spectral Density
PSU-	Power Supply Unit
PUBIT-	Power-Up Built In Test
PUI-	Project Unique Identifier
RAM-	Random Access Memory
RE-	Radiated Emission
REG-	Regulated
RF-	Radio Frequency
RFI-	Radio Frequency Interference
RH-	Relative Humidity
RMS-	Root Mean Square
RS-	Radiated Susceptibility
SRU-	Shop Replaceable Unit
STANAG-	Standard Agreement
S/W-	Software
SyRS-	System Requirements Specification
TBC-	To Be Confirmed
TBD-	To Be Defined

TBR-	To Be Reviewed
TCU-	Temperature Control Unit
UART-	Universal Asynchronous Receiver Transmitter
U.V.-	Under Voltage
VCRM-	Verification Cross Reference Matrix
WD-	Watch Dog

1.4 Glossary

To Be Confirmed (TBC) – Requires further verification or agreement.

To Be Defined (TBD) – A requirement that has yet to be developed.

To Be Reviewed (TBR) – A requirement that might over-constrain the design. This requirement shall be investigated during the preliminary design phase and updated if necessary.

For Future Implementation (FFI) – A requirement which is not necessary for product delivery but may require implementation in future versions. Foundations for implementation should be applied, provided that additional effort is reasonable and does not cause unnecessary risk to the program.

2 Referenced Documents

2.1 Elbit Systems Documents

No.	Title	ID	Revision	Date
1.	Condor-MS SyRS	5495-1000-00PS		
2.	Condor-MS Interface Control Document (ICD)	5495-1000-00IC		
3.	PSU Prime Item Development Specification (PIDS)	5495-6000-00PS		
4.	MIU Prime Item Development Specification (PIDS)	5495-2000-00PS		
5.	System Functional & Operational Requirements Specification (SYS_FRS_ORS)	5495-1000-00FF		

2.2 Others

No.	Title	ID	Revision	Date
6.	Serial Communications (Ethernet)	IEEE 802.3		

3 General Interface Protocol

The interface shall be used to:

- Send commands from the MIU to the PSU for controlling TCUs – ON/OFF.
- Receive BIT status and telemetry information from the PSU.
- Download logfile from the PSU.
- Synchronize GMT time.

The proprietary communication protocol definition shall be as follows:

- Interface Type: Ethernet 100Mbit
- Protocol: Asynchronous
- Format: Little Endian

3.1 UDP message structure

The message structure is described in the following table:

Byte	Content	Remark
1 ÷ N	Message Data	<Length> bytes

3.2 Variables Type Definition

Type	Description
U1	Unsigned, 8-bit integer
U2	Unsigned, 16-bit integer
U4	Unsigned, 32-bit integer
U8	Unsigned, 64-bit integer
S1	Signed, 8-bit integer
S2	Signed, 16-bit integer
S4	Signed, 32-bit integer
S8	Signed, 64-bit integer
Bx	String of x bytes, without terminating NULL

4 MIU to PSU Messages (commands)

The following table is a list of the MIU messages that can be sent to the PSU:

Message ID	Name	Description	Message rate	Message size (Bytes)
0x01	Keep_Alive	Keep alive validation message	1 Hz	1
0x02	TCU_Control	Command to switch off or on any TCU.	Message sent upon event. TCU_Control message is sent only on TCU malfunction event.	3
0x03	Logfile_Maintenance	Start/Stop Logfile recording / Log erase command	Message sent upon event. Logfile_Maintenance message is sent every start / end of a sortie situations.	2
0x04	GMT_Time	Set GMT time	Message sent upon event. Set GMT time message is sent every System Power-On / System Reset events.	7

4.1 Keep Alive Message

The Keep Alive message shall be sent periodically by the MIU, and shall include the following message element:

#	Type	Name	Units	Range	Resolution (Scale factor)	Sign convention	Description	Comments
1	U1	Message_ID	N/A	0x01	N/A	N/A	Unique message ID	

4.2 TCU Control Command

The following command shall be sent as required by the MIU, and includes the following message elements:

#	Type	Name	Units	Range	Resolution (Scale factor)	Sign convention	Description	Comments
1	U1	Message_ID	N/A	0x02	N/A	N/A	Unique message ID	
2	U1	TCU_ID	N/A	0 – 1	N/A	N/A	TCU identification	0x00 – ECTCU 0x01 - CCTCU
3	U1	ON_OFF	N/A	0 – 1	N/A	N/A	ON/OFF command	0x00 – OFF 0x01 – ON

4.3 Logfile Maintenance Command

The following command shall be sent as required by the MIU, and includes the following message elements:

#	Type	Name	Units	Range	Resolution (Scale factor)	Sign convention	Description	Comments
1	U1	Message_ID	N/A	0x03	N/A	N/A	Unique message ID	
2	U1	Start_Stop_Erase_Logfile	N/A	0 – 2	N/A	N/A	Start/Stop Logfile recording / Log erase command	0x00 – Halt and close Logfile. 0x01 - Commence Logfile recording. 0x02 - Erase Logfile.

4.4 GMT Time Command

The following command shall be sent as required by the MIU, and includes the following message elements:

#	Type	Name	Units	Range	Resolution (Scale factor)	Sign convention	Description	Comments
1	U1	Message_ID	N/A	0x04	N/A	N/A	Unique message ID	Set GMT Time
2	U4	GMT_Time	seconds	N/A	1 sec	N/A	Number of seconds elapsed since 00:00 hours, Jan 1, 1970 UTC	
3	U2	Micro_Sec	Micro seconds	N/A	1 Micro second	N/A	Micro seconds in GMT Time	

5 PSU to MIU Messages (status & telemetry)

The following table is a list of the PSU messages that shall be sent to the MIU periodically:

Message ID	Name	Description	Message rate	Message size (Bytes)
0x81	Telemetry_and_BIT	Telemetry and BIT information.	100Hz	187

5.1 Telemetry and BIT Message

- Since PSU status changes can occur intermittently, in order not to miss the occurrence, the faulty notification shall be latched and recorded on the Logfile until sent to the MIU via communication channel. Only after the faulty notification was sent to MIU, it will be cleared.

The following status message shall be sent periodically by the PSU, and shall include the following message elements:

#	Type	Name	Units	Range	Resolution (Scale factor)	Sign convention	Description	comments
1	U1	Message_ID	N/A	0x81	N/A	N/A	Unique message ID	
2	S2	VDC_IN	VDC	+/- 100VDC	50mV	N/A	28VDC Input voltage	
3	S2	VAC_IN_PH_A	VAC	+/- 200VAC	100mV	N/A	115 VAC phA input voltage	
4	S2	VAC_IN_PH_B	VAC	+/- 200VAC	100mV	N/A	115 VAC phB input voltage	
5	S2	VAC_IN_PH_C	VAC	+/- 200VAC	100mV	N/A	115 VAC phC input voltage	
6	S2	I_DC_IN	A DC	+/- 100A	50mA	N/A	Input DC current	
7	S2	I_AC_IN_PH_A	A AC	+/- 200A	50mA	N/A	AC phA input current	
8	S2	I_AC_IN_PH_B	A AC	+/- 200A	50mA	N/A	AC phB input current	
9	S2	I_AC_IN_PH_C	A AC	+/- 200A	50mA	N/A	AC phC input current	
10	S2	V_OUT_1	VDC	+/- 100VDC	50mV	N/A	Output Voltage to Fan CCA	
11	S2	V_OUT_2	VDC	+/- 100VDC	50mV	N/A	Output Voltage to	

							MWIR Cooler	
12	S2	V_OUT_3_ph1	VAC	+/- 200VAC	100mV	N/A	Output Voltage to ADLS phase 1	
13	S2	V_OUT_3_ph2	VAC	+/- 200VAC	100mV	N/A	Output Voltage to ADLS phase 2	
14	S2	V_OUT_3_ph3	VAC	+/- 200VAC	100mV	N/A	Output Voltage to ADLS phase 3	
15	S2	V_OUT_4	VAC	+/- 200VAC	100mV	N/A	Output Voltage to EDU phase 1	
16	S2	V_OUT_5	VDC	+/- 100VDC	50mV	N/A	Output Voltage to VNIR channel	
17	S2	V_OUT_6	VDC	+/- 100VDC	50mV	N/A	Output Voltage to SWIR/MWIR channel	
18	S2	V_OUT_7	VDC	+/- 100VDC	50mV	N/A	Output Voltage to MCC	
19	S2	V_OUT_8	VDC	+/- 100VDC	50mV	N/A	Output Voltage to MIU	
20	S2	V_OUT_9	VDC	+/- 100VDC	50mV	N/A	Output Voltage to LOS motors	
21	S2	V_OUT_10	VDC	+/- 100VDC	50mV	N/A	Output Voltage to INS / EDU / SPARE	
22	S2	I_OUT_1	A DC	+/- 100A	50mA	N/A	Output Current to Fan CCA	
23	S2	I_OUT_2	A DC	+/- 100A	50mA	N/A	Output Current to MWIR Cooler	
24	S2	I_OUT_3_ph1	A AC	+/- 200A	100mA	N/A	Output Current to ADLS_phase 1	

25	S2	I_OUT_3_ph2	A AC	+/- 200A	100mA	N/A	Output Current to ADLS_phase 2	
26	S2	I_OUT_3_ph3	A AC	+/- 200A	100mA	N/A	Output Current to ADLS_phase 3	
27	S2	I_OUT_4	A AC	+/- 200A	100mA	N/A	Output Current to EDU phase 1	
28	S2	I_OUT_5	A DC	+/- 100A	50mA	N/A	Output Current to VNIR channel	
29	S2	I_OUT_6	A DC	+/- 100A	50mA	N/A	Output Current to SWIR/MWIR channel	
30	S2	I_OUT_7	A DC	+/- 100A	50mA	N/A	Output Current to MCC	
31	S2	I_OUT_8	A DC	+/- 100A	50mA	N/A	Output Current to MIU	
32	S2	I_OUT_9	A DC	+/- 100A	50mA	N/A	Output Current to LOS motors	
33	S2	I_OUT_10	A DC	+/- 100A	50mA	N/A	Output Current to INS / EDU / SPARE	
34	U2	AC_Power	VA	10KW	1VA	N/A	Total AC Power Consumption	
35	U2	Fan_Speed	RPM	[1 - 30,000]	1RPM	N/A	PSU Fan Speed	
36	U8	Volume_size	Bytes	<5Gbyte	1	N/A	Log Volume < 5Gbyte	
37	U8	Logfile_size	Bytes	<5Gbyte	1	N/A	Logfile Size < 5Gbyte	
38	S1	T1	°C	+/- 127°C	1°C	N/A	Thermistor 1	
39	S1	T2	°C	+/- 127°C	1°C	N/A	Thermistor 2	
40	S1	T3	°C	+/- 127°C	1°C	N/A	Thermistor 3	
41	S1	T4	°C	+/- 127°C	1°C	N/A	Thermistor 4	

42	U4	ETM	minutes	N/A	1min	N/A	Elapsed Time Meter	
43	U1	Major	N/A	00-FF	N/A	N/A	Software Version Major	
44	U1	Minor	N/A	00-FF	N/A	N/A	Software Version Minor	
45	U1	Build	N/A	00-FF	N/A	N/A	Software Version Build	
46	U1	Hotfix	N/A	00-FF	N/A	N/A	Software Version Hotfix	
47	U1	SN	N/A	00-FF	N/A	N/A	Serial Number	
48	U8	PSU_Status	N/A	N/A	N/A	N/A	PSU Status	PSU Status
49	U1	Control_Panel_Lamp_Indication	N/A	0 – 3	N/A	N/A	Control Panel Lamp Indication	0x00 – Lamp in OFF indication. 0x01 - Lamp in ON indication. 0x02 - Lamp in Flash (fast rate) indication. 0x03 - Lamp in Flash (slow rate) indication.
50	U8	Spare	N/A	N/A	N/A	N/A	N/A	
51	U8	Spare	N/A	N/A	N/A	N/A	N/A	
52	U8	Spare	N/A	N/A	N/A	N/A	N/A	
53	U8	Spare	N/A	N/A	N/A	N/A	N/A	
54	U8	Spare	N/A	N/A	N/A	N/A	N/A	
55	U8	Spare	N/A	N/A	N/A	N/A	N/A	

56	U8	Spare	N/A	N/A	N/A	N/A	N/A	
57	U8	Spare	N/A	N/A	N/A	N/A	N/A	
58	U8	Spare	N/A	N/A	N/A	N/A	N/A	
59	U8	Spare	N/A	N/A	N/A	N/A	N/A	

PSU Status:

Data bits	Description	Values	Default Value	Remarks
0	DC_IN_Status	0=OK 1=FAIL	0	DC Input Voltage Status - OK (0) or Fail (1)
1	AC_IN_Status	0=OK 1=FAIL	0	AC Input Voltage Status - OK (0) or Fail (1)
2	Power_Out_Status	0=OK 1=FAIL	0	Output power Status - OK (0) or Fail (1)
3	MIU_COM_Status	0=OK 1=FAIL	0	MIU Communication Status - OK (0) or Fail (1)
4	OUT1_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output1
5	OUT2_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output2
6	OUT3_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output3
7	OUT4_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output4
8	OUT5_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output5

9	OUT6_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output6
10	OUT7_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output7
11	OUT8_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output8
12	OUT9_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output9
13	OUT10_OC	0=OK 1=Overcurrent	0	Overcurrent Indication for Output10
14	DC_IN_OV	0=OK 1=Overvoltage	0	Overvoltage indication for DC Input
15	OUT1_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output1
16	OUT2_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output2
17	OUT3_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output3
18	OUT4_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output4
19	OUT5_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output5
20	OUT6_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output6
21	OUT7_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output7

22	OUT8_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output8
23	OUT9_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output9
24	OUT10_OV	0=OK 1=Overvoltage	0	Overvoltage Indication for Output10
25	DC_IN_UV	0=OK 1=Undervoltage	0	Undervoltage indication for DC Input
26	AC_IN_UV	0=OK 1=Undervoltage	0	Undervoltage indication for AC Input
27	PH1_Status	0=OK 1=MISSING	0	Phase 1 OK (0) or missing indication (1)
28	PH2_Status	0=OK 1=MISSING	0	Phase 2 OK (0) or missing indication (1)
29	PH3_Status	0=OK 1=MISSING	0	Phase 3 OK (0) or missing indication (1)
30	Neutral_Status	0=OK 1=MISSING	0	Neutral OK (0) or missing indication (1)
31	Is_Logfile_Running	0= Logfile not Running 1= Logfile Running	0	Is Logfile running?
32	Is_Logfile_Erase_In _Process	0 = Logfile not in erase process 1 = Logfile in erase process	0	Is Logfile Erase In process?
33	OVER_TEMP_Status	0 = OK 1 = Over Temperature	0	PSU Temperature OK (0) or Over Temperature indication (1)

34	CC_Inhibit	0 = OFF 1 = ON	0	CCTCU OFF (0) or ON (1) indication
35	EC_Inhibit	0 = OFF 1 = ON	0	ECTCU OFF (0) or ON (1) indication
36	System_Reset	0 = Short Reset Not Initiated 1 = Short Reset Initiated	0	Short Reset Initiated indication. Intermittent indication to Logfile.
37	System_Off	0 = Power Down Process Not Initiated 1 = Power Down Process Initiated	0	Power Down Process Initiated indication. Intermittent indication to Logfile.
38	MIU_Watchdog_Status	0 = Watchdog Status - OK 1 = Watchdog Status - Fail	0	MIU Watchdog Status - OK (0) or Fail (1) The PSU samples the MIU Watchdog line, implemented as a discrete that changes state at 1Hz rate.
39	ON_OFF_Switch_State	0 = ON/OFF Switch in OFF State 1 = ON/OFF Switch in ON State	0	ON/OFF Switch State indication
40	Capacitor1_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-1 end of life indication - Optional TBD
41	Capacitor2_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-2 end of life indication - Optional TBD
42	Capacitor3_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-3 end of life indication - Optional TBD

43	Capacitor4_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-4 end of life indication - Optional TBD
44	Capacitor5_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-5 end of life indication - Optional TBD
45	Capacitor6_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-6 end of life indication - Optional TBD
46	Capacitor7_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-7 end of life indication - Optional TBD
47	Capacitor8_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-8 end of life indication - Optional TBD
48	Capacitor9_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-9 end of life indication - Optional TBD
49	Capacitor10_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-10 end of life indication - Optional TBD
50	Capacitor11_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-11 end of life indication - Optional TBD
51	Capacitor12_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-12 end of life indication - Optional TBD
52	Capacitor13_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-13 end of life indication - Optional TBD
53	Capacitor14_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-14 end of life indication - Optional TBD
54	Capacitor15_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-15 end of life indication - Optional TBD
55	Capacitor16_end_of_life	0 = Capacitor OK 1 = Capacitor end of life	0	Capacitor-16 end of life indication - Optional TBD

56	Spare			
57	Spare			
58	Spare			
59	Spare			
60	Spare			
61	Spare			
62	Spare			
63	Spare			

6 PSU Logfile Structure

6.1 PSU Logfile handling - general rules

- Logfile shall be recorded in the PSU at 1KHz rate.
- PSU Logfile shall consist a sequence of recorded files where the size of these files will be determined by a parameter.
- These PSU recorded files shall be combined into complete sorties Logfiles after the Postflight Logfile download phase.
- The Date & Time shall be recorded in the PSU Logfile immediately upon power-up. The GMT Time will be updated in the Logfile later from the MIU. The gap between Date & Time recorded at the power-up and the GMT Time updated by the MIU, shall be treated in the Log-Tracker after the Postflight Logfile download phase.

6.2 PSU Logfile structure:

#	Name	Description	comments
1	Log_Header	Log Header	Log Header
2	Log Payload	The fields structure of the Log Payload is defined in the PSU Telemetry and BIT Message (not including the message ID Byte)	
3	Log_Trailer	Log Trailer	Log Trailer

[Log Header:](#)

#	Name	Description	Variables Type	Default Value	Remarks
1	Log_ID	Log ID	B10	"LX12345678"	
2	Log_Payload_Size	Payload Size [Bytes]	U1	0	Not including this Log Header
3	GMT_Time	number of seconds elapsed since 00:00 hours, Jan 1, 1970 UTC	U4	0	
4	Micro_Sec	micro seconds in GMT Time	U2	0	

Log Trailer:

#	Name	Description	Variables Type	Default Value	Remarks
1	Checksum	Sum of all log header and log payload bytes	U1	0	