SRS

XMPS-1000

(GUI for programming software of PLC)

Version<2.0>

1. **Graphical UI of programming software**
   Ladder, Predefined FB, user defined FB etc.
2. **Interpreter**

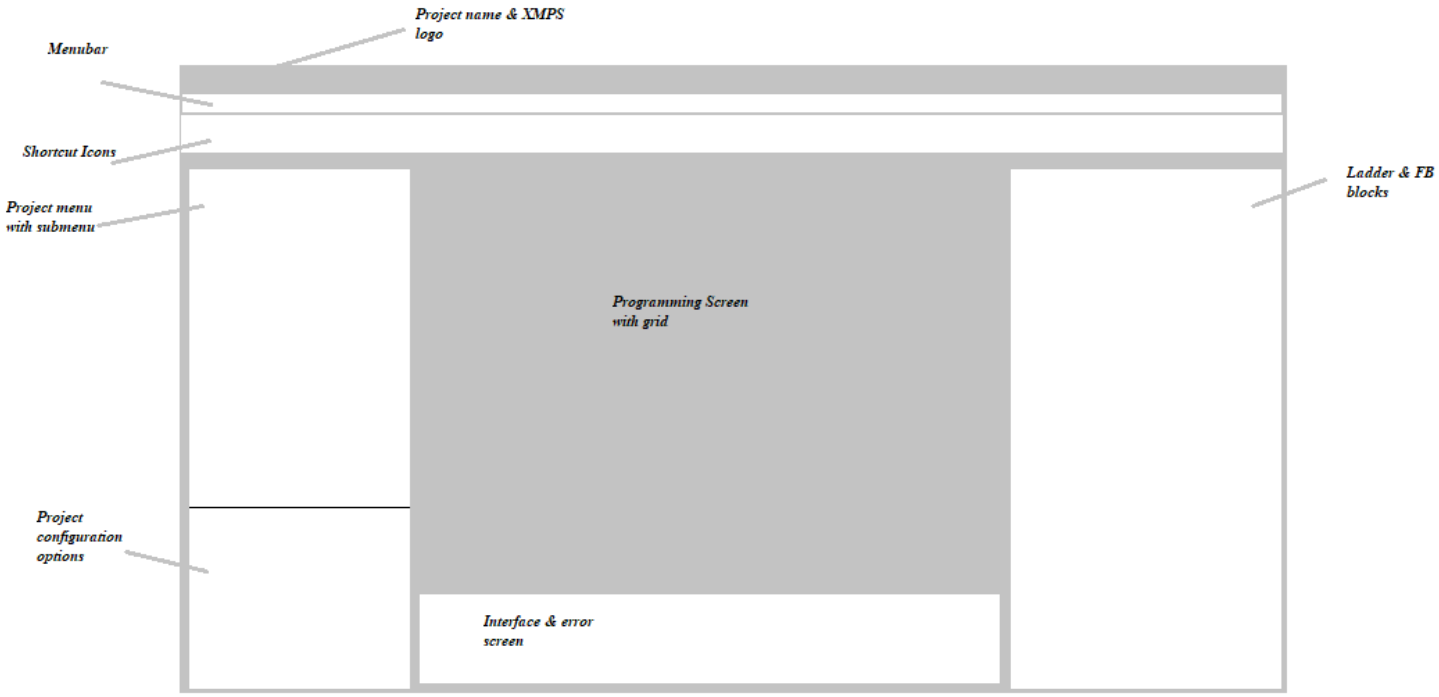
1. Introduction :

This is the Software Requirements Specification (SRS) document which provides an overview of the entire XMPS-1000 requirements.

2. Purpose:

In short, the purpose of this SRS document is to provide a detailed overview of our XMPS- 1000 software product, its parameters and goals. This document describes the project's user interface requirements. It will explain the purpose and features of the system, the interfaces of the system, Interpreter (code generation).

Provisional Proposed UI :



4. Menu Bar :

4.1. Project : In "Project" menu following options should be added.

4.1.1 New Project

Frontend-New Project

Backend – a. New path for project

b. Select CPU option

c. If existing path choosed popup of warning.

4.1.2 Open Project

Frontend- Open Project

Backend- a. Open project popup

b. If exixsting project not saved then popup for saving the project

4.1.3 - Save project

Frontend- Save project

Backend- a.Save project latest changes

4.1.4 Save As..

Frontend-Save As..

Backend- a.Ask for saving project path

4.1.5 Close Project

Frontend- Close Project

Backend- a. Save the latest changes and close the project

b. only project should close not programming software

4.1.6 Print

Frontend- Print

Backend- a. Same as what we have done in XMPS-100

Print the ladder main program & configuration settings.

4.1.7 Exit

Frontend-Exit

Backend- a.Save and close the software.

4.2 Edit : In “Edit” menu following options should be added.

4.2.1 Undo

Frontend-Undo

Backend- a. Undo the latest change (atleast last 15 changes)

4.2.2 Redo

Frontend- Redo

Bacckend- a. Redo the changes (atleast 15 changes)

4.2.3 Copy

Frontend-Copy

Backend- a. Copy the selescted rung/instruction

b. Copy the selected project folder

c. Copy the selected program logic file

4. 2.4 Paste

Frontend-Paste

Backend- a.Paste the copied /cutted rung, instruction

b. Paste the copied/cutted folder

c. Paste the copied program logic file

4. 2.5 Cut

Frontend-Cut

Backend- a.Cut the selected rung/ instruction

b. Cut the folder

c. Cut the Program logic file

4. 2.6 Delete

Frontend-Delete

Backend- a.Delete the selected rung/ instruction

b. Delete the slecetd folder

c. Delet the selected program logic file

4.2.7 Find & Replace

Frontend-Find & Replace

Backend- a. Find the text

b. Fing & replace the text

4.3 View : In “View” menu following options should be added.

4.3.1 Device info

Frontend-Device info

After Click- It will show the XMPRo CPU parameters

4.3.2 Zoom

Frontend-Zoom

Backend-Should able to zoom the programming grid window

4.3.3 Project Window

Frontend-Project Window

Backend-After click project window should Enable or Disable

4.3.4 Compiler error screen

Frontend-Compiler error screen

Backend-After click compiler screen should Enable or Disable

4.4 Mode : In “Mode” menu following options should be added.

4.4.1 Login

Frontend- Login

Backend-Sotware should connect with PLC via ethernet port & all editable functions should be disable, no program will edit in this mode only start & stop plc command should accept.

Online Monitering option should enable.

4.4.2 Logout

Frontend-Logout

Backend- Logout the Login mode and Normal mode activate.

4.4.3 Download Project

Frontend- Download Project

Backend-Save - Compile - Download the compiled file into the PLC via ethernet port

4.4.4 Upload Project

Frontend- Upload project

Backend- Upload the project from PLC & display the project

4.4.5 Offline Simulation

Frontend-Offline simulation

Backend- TBD

4.4.6 PLC Start

Frontend- PLC start

Backend-PLC start command shoud go to PLC & this mode should active only if the user is Login to PLC

4.4.7 PLC Stop

Frontend- PLC stop

Backend-PLC stop command shoud go to PLC & this mode should active only if the user is Login to PLC

4.4.8 Compile

Frontend- Compile

Backend- Generate code as per requirement.

4.5 Help : In “Help” menu following options should be added.

4.5.1 Index

Frontend Index

After click the Index of XMPS-1000 intruction help window should be open. And after clicking each of index point it will show the detail information of perticuler point.

4.5.2 Contents

Frontend-Contents

After click the Contents all help related to XMPS-1000 software should open.

4.5.3 Search

Frontend-Search

Should open the search bar for the user.

4.5.4 User amnual

User manual PDf open.

5. Shortcut Bar :

In shortcut bar following symbols should be present:

5.1 New
5.2 Open
5.3 Save
5.4 Project close
5.5 Upload
5.6 Download
5.7 Zoom IN
5.8 Zoom out
5.9 Zoom % selection
5.10 Compile
5.11 Login
5.12 Logout
5.13 Run Online Monitering
5.14 Help
5.15 Cut
5.16 Copy
5.17 Paste
5.18 Select
5.19 Undo
5.20 Redo
5.21 Delete
5.22 Previous screen
5.23 Next screen
5.24 Find
5.25 Ladder components (Contact,Coil,Parallel contact,Parallel coil, Variable,New rung,New comment)

After click on perticuler shortcut related action should be taken.

6. Project Menu

In Left side of screen there should be the Project Menu with the Submenus as follows:

-All files

6.1 Project List

6.1.1 Project name XXXXXX

6.1.1.1 Powerup routine (Init)

6.1.1.1.1 Logic 1

6.1.1.1.2 Logic 2

6.1.1.1.3 xxxxxx

6.1.1.2 Main

6.1.1.2.1 Main program (should call the Logic blocks as per sequence)

6.1.1.3 Library

6.1.1.3.1 Logic blocks

6.1.1.3.1.1 Logic 1

6.1.1.3.1.2 Logic 2

6.1.1.3.1.3 Logic 3

6.1.1.3.1.4 Logic 4

6.1.1.3.1.5 xxxxxx

6.1.1.3.2 Hardware Interrupt

6.1.1.3.2.1 Logic 1

6.1.1.3.2.2 Logic 2

6.1.1.3.3 UDFB

6.1.1.3.3.1 FB 1 xxxxx

6.1.1.3.3.2 FB 2 xxxxx

6.1.1.3.3.3 FB 3 xxxxx

6.1.1.4 IO configuration

6.1.1.4.1 Base (XMPRO-10)

6.1.1.4.2 Local IO 1 (xxxx)

6.1.1.4.3 Local IO 2 (xxxx)

6.1.1.4.4 Local IO 3 (xxxx)

6.1.1.4.5 Local IO 4 (xxxx)

6.1.1.4.6 Local IO 5 (xxxx)

6.1.1.5 Tags

6.1.1.6 Error diagnostic tags

6.1.1.7 System Configuration

6.1.1.7.1 Ethernet

6.1.1.7.1.1 Modbus TCP Server

6.1.1.7.1.2 Modbus TCP Client

6.1.1.7.1.2.1 Slave 1

6.1.1.7.1.2.2 Slave 2

6.1.1.7.1.2.3 Slave 3
6.1.1.7.1.2.4 xxxxxx
6.1.1.7.2 RS485
6.1.1.7.2.1 Modbus RTU Master
6.1.1.7.2.1.1 Slave 1 (MOD-DI-8)
6.1.1.7.2.1.2 Slave 2 (xxxxx)
6.1.1.7.2.1.3 Slave 3 (xxxxx)
6.1.1.7.2.1.4 Xxxxx
6.1.1.7.3 CAN
6.1.1.7.3.1 CANOpen Master
6.1.1.7.3.1.1 CANOpen Slave 1 (CAN -DI16)
6.1.1.7.3.1.2 CANOpen Slave 2
6.1.1.7.3.1.3 CANOpen Slave 3
6.1.1.7.3.1.4 xxxxxxx
6.1.2 Project name XXXXXX

Same as project 1 …….

All tabs should include the dedicated screen as defined below.

Project name Screen- After click it should display the overall program information

(No.of Power up blocks, No of Logic blocks,Total IO used,Total tags defined etc)

Powerup routine (Init) Screen- Under this tab Logic blocks should be added as per requirement of user.

Main- Under this tab one “Main Program” block should add. Here user can call the Logic blocks as per their sequence. (It will be the programming grid screen)

Library- In this tab user should able to select the which following library he wants to use for his application.

Logic blocks-Under this tab user should add the Logic blocks as per their requiement and should rename that block as per their requirement.

Hardware interrupt- In this tab user should configure the Interrupt Input and Under that Input tab user should add the Logic blocks which should run when Interrupt is occure.

UDFB- User defined function block. Under this tab user can create his own programmed function block.

Function block has Inputs & outputs, so user will able to add the Inputs & can create his own logic as per received input and gives the Output.

IO configuration- Under this tab user should able to configure the Onboard and Local IO modules.

Tags- In this tab all pregenerated CPU & Local IO tags should be automatically assigned as per predefined address.

User can able to add the memory tags as per their requirement in Logic block screen only and same tag should add in Tags screen automatically.

User should able to rename the tag name only.

User should able to add the memory address tags as per their requirement.

All memory tags which will generate in all logic blocks during the program should add here automatically.

Error Diagnostic tags- In this tab all predefined error tags will be added as per added configuration.

System Configuration- Under this tab all settings and requests of Ethernet,Modbus TCP Server,Modbus TCP Client,RS485,Modbus RTU masterSlave 1,Slave 2,Slave xxx ,CAN, CANOpen master,CANOpen slave 1, CANOpen slave xx should be added.

7. Ladder & FB Blocks screen

This screen should be activate when user will click on any Logic block screen.

Under this screen all below instructions predefined FB should be present.

All Ladder components should be present here.

All UDFB blocks also should be added here automatically when user creates any UDFB.

A. Ladder components:

7.1 Contact
7.2 Coil
7.3 Insert after contact
7.4 Parallel Contact
7.5 Insert FB
7.6 Variable
7.7 Set Coil
7.8 Reset Coil
7.9 Negate Contact
7.10 Negate Parallel contact
7.11 Comment
7.12 Insert branch

B. Predefined Function blocks:

7.13 Logical
- 7.13.1 AND
- 7.13.2 OR
- 7.13.3 XOR
- 7.13.4 NOT

7.14 Arithmatic
- 7.14.1 ADD
- 7.14.2 SUB
- 7.14.3 MUL
- 7.14.4 DIV
- 7.14.5 MOD
- 7.14.6 MOV

7.15 Bitshift
- 7.15.1 SHL
- 7.15.2 SHR
- 7.15.3 ROR
- 7.15.4 ROL

7.16 Limit
7.17 Compare
- 7.17.1 GT
- 7.17.2 GE
- 7.17.3 LT
- 7.17.4 LE
- 7.17.5 EQ
- 7.17.6 NE

7.18 Edge detector

7.18.1 Rising edge
7.18.2 Falling edge
7.19 Counter
7.19.1 CTU
7.19.2 CTD
7.20 Timer
7.20.1 0.01S TON
7.20.2 0.1S TON
7.20.3 1S TON
7.20.4 0.01S TOFF
7.20.5 0.1S TOFF
7.20.6 1S TOFF
7.20.7 0.01S TP
7.20.8 0.1S TP
7.20.9 1S TP
7.21 Flipflop
7.21.1 RS
7.21.2 SR

8. Interface & Error screen

8.1 This screen will appear when user will build or compile the project and shows the status of compilation. If any error is present then it should show the error.

(Next version of this document will explain the details about this screen).

9. Programming grid screen

In this screen user can drag and drop the all ladder components & function blocks.

Screen grid should be adjustable.

Presently we will limit the 8 ladder components in one rung.

And same for parallel also, we will limit this to 8 rungs.

Use the right click & double click for adding & displaying the ladder components & its information.

10. Interpreter

10.1 Application program interpreter

Logic blocks which is called sequentially in “Main program” tab should create the “MCode” buffer as per the given format.

Eg—

Main Program

Motor1
Motor2
Motor3

Library

Logic blocks

Motor1------50 rungs of logic

Motor2------20 rungs of logic

Motor3------30 rungs of logic

Motor4------60 rungs of logic

In above example under the “Main program” tab we have called the 3 logic blocks. “Motor1”, “Motor2”, “Motor3”. So, 50 + 20 + 30 =100 rungs of MCode should be generated sequentially when user click on compile/generate code option.

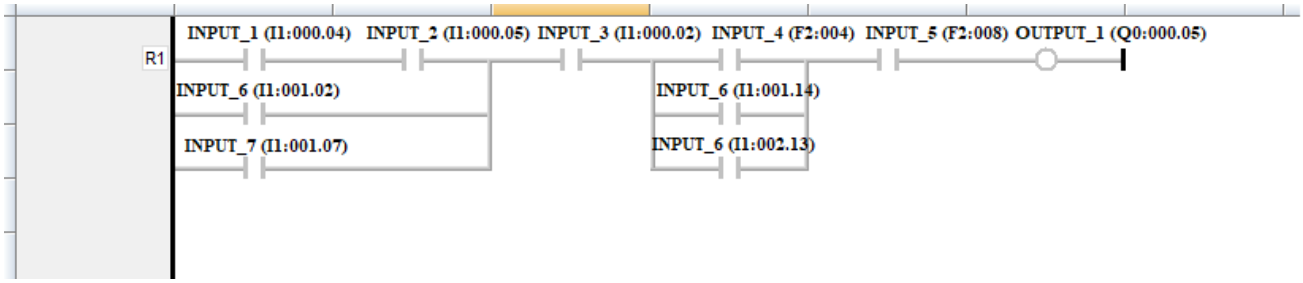
All logic blocks should save in the laptop memory when user opens the existing project all blocks should open as it is.

GUI Logic:

1. When user added any ladder component or function block in a programming grid then at backend the equivalent C code should create.
2. C code should create using the CPU defined address only. Not by user defined tags
3. CPU address details as follows:

XM-Pro CPU Addressing Scheme				
Block No	**Type**	**Logical Address Range**	**Used as**	**Remark**
0	Output address	Q0:000 to Q0:255	Word and Bit	Physical Digital+Analog Outputs. (local+Expn+Remote)
1	Input adress	I1:000 to I1:255	Word and Bit	Physical Digital+Analog Inputs. (local+Expn+Remote)
2	Flags (Memory bits)	F2.000 to F2.255	Bit	Memory bits
3	Status	S3:000 to S3:255	Word	PLC Status & dignostics
4	Integer Word	W4:000 to W4:255	Word	Memory word address
5	Floating Point	P5:000 to P5:255	Real	Memory Real address
6	Timers	T6:000 to T6:255	Word	Timer word address
7	Counters	C7:000 to C7:255	Word	Counter word address
8	Reserved for future	X8.000 to X8.255	Word	
9	Reserved for future	Y9.000 to Y9.255	Word	
10	Auto memory flag	D10:000 to D10:2048	Bit	Auto generated flags not for user, it will create by utility when user added multiple ladder components , function blocks in parallal with one rung

4. Ex-1 : Following is the example for creating Mcode:



Equivalent backend code for above rung-

Q0:000.05=(((I1:000.04 AND I1:000.05) OR I1:001.02 OR I1:001.07) AND (I1:000.02) AND (F2:004 OR I1:001.14 OR I1:002.13) AND F2:008);

5. This equivalent code should convert into Messung “Mcode” format.
6. Messung Mcode format for 1 Rung is:

1	Rung No.	4	byte
2	Data type	4	byte
3	Enable Type	4	byte
4	Enable	4	byte
5	OPCODE	4	byte
6	Type of operand 1	4	byte
7	OP1	4	byte
8	Type of operand 2	4	byte
9	OP2	4	byte
10	Type of operand 3	4	byte
11	OP3	4	byte
12	Type of operand 4	4	byte
13	OP4	4	byte
14	Type of operand 5	4	byte
15	OP5	4	byte
16	Type of operand 6	4	byte
17	OP6	4	byte
18	Type of operand 7	4	byte
19	OP7	4	byte
20	Type of operand 8	4	byte
21	OP8	4	byte
22	No. of Operand	4	byte
23	T_C Name	4	byte
24	Output 1	4	byte
25	Output 2	4	byte

MCODE detailed description is in section 11

7. Above Ex1 equivalent C code conversion example for Mcode buffer creation:

Q0:000.05=(((I1:000.04 AND I1:000.05) OR I1:001.02 OR I1:001.07) AND (I1:000.02) AND (F2:004 OR I1:001.14 OR I1:002.13) AND F2:008);

Rung 1---
D10:000=I1:000.04 AND I1:000.05
Rung 2---
D10:001=D10:000 OR I1:001.02 OR I1:001.07
Rung 3---
D10:002=D10:001 AND I1:000.02
Rung 4---
D10:003=F2:004 OR I1:001.14 OR I1:002.13
Rung 5---
Q0:000.05=D10:002 AND D10:003 AND F2:008

8. Mcode for above Ex1—(not actual calculated address of Oprands just dummy address)

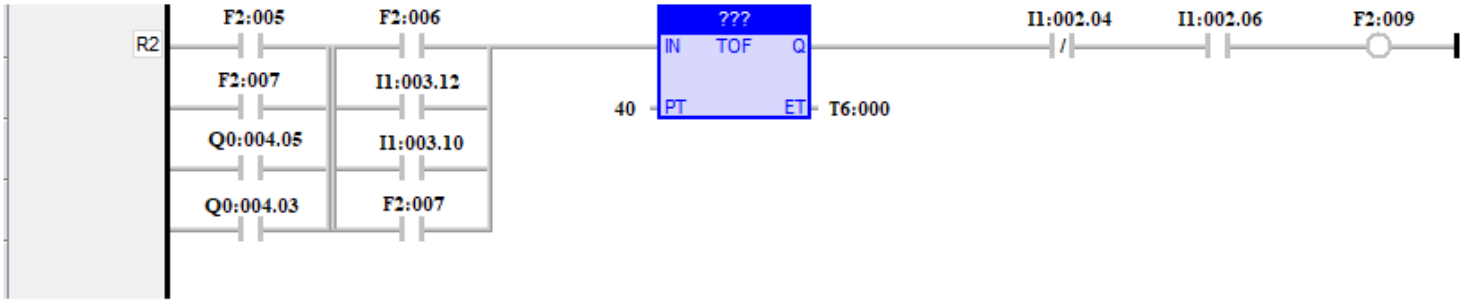
Sr.no.	*Description*	*Actual Mcode Buffer values*	*explanation*
1	Rung No.	0x01	
2	Data type	0x00	
3	Enable Type	0x00	
4	Enable	-	
5	OPCODE	0x0000	AND
6	Type of operand 1	0x01	
7	OP1	0x22204000	Actual address of I1:000.04
8	Type of operand 2	0x01	
9	OP2	0x22204001	Actual address of I1:000.05
10	Type of operand 3	-	
11	OP3	-	
12	Type of operand 4	-	
13	OP4	-	
14	Type of operand 5	-	
15	OP5	-	
16	Type of operand 6	-	
17	OP6	-	
18	Type of operand 7	-	
19	OP7	-	
20	Type of operand 8	-	
21	OP8	-	
22	No. of Operand	0x02	
23	T_C Name	-	
24	Output 1	0x20034445	Actual address of D10:000
25	Output 2	-	
26	Rung No.	0x02	
27	Data type	0x00	
28	Enable Type	0x00	
29	Enable	-	
30	OPCODE	0X0010	OR

31	Type of operand 1	0x01	
32	OP1	0x22204002	Actual address of D10:000
33	Type of operand 2	0x01	
34	OP2	0x22204003	Actual address of I1:001.02
35	Type of operand 3	0x01	
36	OP3	0x22204004	Actual address of I1:001.07
37	Type of operand 4	-	
38	OP4	-	
39	Type of operand 5	-	
40	OP5	-	
41	Type of operand 6	-	
42	OP6	-	
43	Type of operand 7	-	
44	OP7	-	
45	Type of operand 8	-	
46	OP8	-	
47	No. of Operand	0x03	
48	T_C Name	-	
49	Output 1	0x20034447	Actual address of D10:001
50	Output 2	-	
51	Rung No.	0x03	
52	Data type	0x00	
53	Enable Type	0x00	
54	Enable	-	
55	OPCODE	0X0000	AND
56	Type of operand 1	0x01	
57	OP1	0x22204005	D10:001
58	Type of operand 2	0x01	
59	OP2	0x22204006	I1:000.02
60	Type of operand 3	-	
61	OP3	-	
62	Type of operand 4	-	
63	OP4	-	
64	Type of operand 5	-	
65	OP5	-	
66	Type of operand 6	-	
67	OP6	-	
68	Type of operand 7	-	
69	OP7	-	
70	Type of operand 8	-	
71	OP8	-	
72	No. of Operand	0x02	
73	T_C Name	-	
74	Output 1	0x20034447	D10:002
75	Output 2	-	

76	Rung No.	0x04	
77	Data type	0x00	
78	Enable Type	0x00	
79	Enable	-	
80	OPCODE	0X0010	OR
81	Type of operand 1	0x01	
82	OP1	0x22204008	F2:004
83	Type of operand 2	0x01	
84	OP2	0x22204009	I1:001.14
85	Type of operand 3	0x01	
86	OP3	0x22204010	I1:002.13
87	Type of operand 4	-	
88	OP4	-	
89	Type of operand 5	-	
90	OP5	-	
91	Type of operand 6	-	
92	OP6	-	
93	Type of operand 7	-	
94	OP7	-	
95	Type of operand 8	-	
96	OP8	-	
97	No. of Operand	0x03	
98	T_C Name	-	
99	Output 1	0x20034448	D10:003
100	Output 2	-	
101	Rung No.	0x05	
102	Data type	0x00	
103	Enable Type	0x00	
104	Enable	-	
105	OPCODE	0X0000	AND
106	Type of operand 1	0x01	
107	OP1	0x22204011	D10:002
108	Type of operand 2	0x01	
109	OP2	0x22204012	D10:003
110	Type of operand 3	0x01	
111	OP3	0x22204013	F2:008
112	Type of operand 4	-	
113	OP4	-	
114	Type of operand 5	-	
115	OP5	-	
116	Type of operand 6	-	
117	OP6	-	
118	Type of operand 7	-	
119	OP7	-	
120	Type of operand 8	-	
121	OP8	-	
122	No. of Operand	0x03	
123	T_C Name	-	

124	Output 1	0x20034449	Q0:000.05
125	Output 2	-	

9. Ex-2: (Not mentioning user tags just mentioning equivalent address…consider there will be an user tags)



Equivalent C code for above-

F2:009=(TOF0.01S_T151((F2:005 OR F2:007 OR Q0:004.05 OR Q0:004.03) AND (F2:006 OR I1:003.12 OR I1:003.10 OR F2:007)) 40 , T151.Q , T6:000) AND (NOTI1:002.04 AND I1:002.06))

10. Above Ex2 equivalent code conversion example for Mcode buffer creation:

Rung 1---

D10:000=F2:005 OR F2:007 OR Q0:004.05 OR Q0:004.03

Rung 2---

D10:001=F2:006 OR I1:003.12 OR I1:003.10 OR F2:007

Rung 3---

D10:002=D10:000 AND D10:001

Rung 4---

D10:003=NOTI1:002.04 AND I1:002.06

Rung 5---

D10:004,T6:000 =TOF 0.01S_T151(D10:002 , 40)

Rung 6---

F2:009=D10:004 AND D10:003

11. Mcode for above Ex2— (not actual calculated address of Oprands just dummy address)

Sr.no.	Description	Actual Mcode Buffer values	Explanation
1	Rung No.	0x01	
2	Data type	0x00	
3	Enable Type	0x00	
4	Enable	-	
5	OPCODE	0x0010	OR
6	Type of operand 1	0x01	
7	OP1	0x22204000	F2:005
8	Type of operand 2	0x01	
9	OP2	0x22204001	F2:007
10	Type of operand 3	0x01	
11	OP3	0x22204002	Q0:004.05
12	Type of operand 4	0x01	
13	OP4	0x22204003	Q0:004.03
14	Type of operand 5	-	
15	OP5	-	
16	Type of operand 6	-	
17	OP6	-	
18	Type of operand 7	-	
19	OP7	-	
20	Type of operand 8	-	
21	OP8	-	
22	No. of Operand	0x04	
23	T_C Name	-	
24	Output 1	0x20034447	D10:000
25	Output 2	-	
26	Rung No.	0x02	
27	Data type	0x00	
28	Enable Type	0x00	
29	Enable	-	
30	OPCODE	0X0010	OR
31	Type of operand 1	0x01	
32	OP1	0x22204012	F2:006
33	Type of operand 2	0x01	
34	OP2	0x22204013	I1:003.12
35	Type of operand 3	0x01	
36	OP3	0x22204014	I1:003.10
37	Type of operand 4	0x01	
38	OP4	0x22204015	F2:007
39	Type of operand 5	-	
40	OP5	-	
41	Type of operand 6	-	
42	OP6	-	
43	Type of operand 7	-	
44	OP7	-	
45	Type of operand 8	-	
46	OP8	-	
47	No. of Operand	0x04	

48	T_C Name	-	
49	Output 1	0x20034447	D10:001
50	Output 2	-	
51	Rung No.	0x03	
52	Data type	0x00	
53	Enable Type	0x00	
54	Enable	-	
55	OPCODE	0X0000	AND
56	Type of operand 1	0x01	
57	OP1	0x22204015	D10:000
58	Type of operand 2	0x01	
59	OP2	0x22204016	D10:001
60	Type of operand 3	-	
61	OP3	-	
62	Type of operand 4	-	
63	OP4	-	
64	Type of operand 5	-	
65	OP5	-	
66	Type of operand 6	-	
67	OP6	-	
68	Type of operand 7	-	
69	OP7	-	
70	Type of operand 8	-	
71	OP8	-	
72	No. of Operand	0x02	
73	T_C Name	-	
74	Output 1	0x20034447	D10:002
75	Output 2	-	
76	Rung No.	0x04	
77	Data type	0x00	
78	Enable Type	0x00	
79	Enable	-	
80	OPCODE	0X0000	AND
81	Type of operand 1	0x02	
82	OP1	0x22204008	NOTI1:002.04
83	Type of operand 2	0x01	
84	OP2	0x22204009	I1:002.06
85	Type of operand 3	-	
86	OP3	-	I1:002.13
87	Type of operand 4	-	
88	OP4	-	
89	Type of operand 5	-	
90	OP5	-	
91	Type of operand 6	-	
92	OP6	-	
93	Type of operand 7	-	
94	OP7	-	
95	Type of operand 8	-	

96	OP8	-	
97	No. of Operand	0x02	
98	T_C Name	-	
99	Output 1	0x20034448	D10:003
100	Output 2	-	
101	Rung No.	0x05	
102	Data type	**0x07**	
103	Enable Type	0x00	
104	Enable	-	
105	OPCODE	0x01E7	TOF0.01S
106	Type of operand 1	0x01	
107	OP1	0x22204011	D10:002
108	Type of operand 2	0x03	
109	OP2	0x22204012	40
110	Type of operand 3	-	
111	OP3	-	
112	Type of operand 4	-	
113	OP4	-	
114	Type of operand 5	-	
115	OP5	-	
116	Type of operand 6	-	
117	OP6	-	
118	Type of operand 7	-	
119	OP7	-	
120	Type of operand 8	-	
121	OP8	-	
122	No. of Operand	0x02	
123	T_C Name	T151	
124	Output 1	0x20034450	D10:004
125	Output 2	0x20037450	T6:000
126	Rung No.	0x06	
127	Data type	**0x00**	
128	Enable Type	0x00	
129	Enable	-	
130	OPCODE	0x0000	AND
131	Type of operand 1	0x01	
132	OP1	0x22204011	D10:004
133	Type of operand 2	0x01	
134	OP2	0x22204012	D10:003
135	Type of operand 3	-	
136	OP3	-	
137	Type of operand 4	-	
138	OP4	-	
139	Type of operand 5	-	
140	OP5	-	
141	Type of operand 6	-	
142	OP6	-	
143	Type of operand 7	-	

144	OP7	-	
145	Type of operand 8	-	
146	OP8	-	
147	No. of Operand	0x02	
148	T_C Name	-	
149	Output 1	0x20038450	F2:009
150	Output 2	-	

12. Before first rung and after last rung there will be some addition like beow.

Before first Rung-

Description			
SOF	$	1	byte
No. of Rungs	MAX 1000	2	byte

After Last Rung-

Description			
EOF	#	1	byte

11. MCode details.

11.1 SOF- Start of Frame ---

We have defined "$" as a start of Mcode buffer.
Size - 1 byte

11.2 No. of Rungs---

No. of rungs will be calculate after compilation of code of total no. of Mcode rungs.

Size-2 bytes

11.3 Rung no.---

Rung no. ---Rung no as per sequential flow of program
Size- 2 bytes

11.4 Data Type---

As per Opcode –(defined earlier same as per XMPS-100)
Size- 2 bytes

Datatype representation in OPCODE	**Description**

0x0000	**BOOL**
0x0001	**BYTE**
0x0002	**WORD**
0x0003	**DOUBLE WORD**
0x0004	**INT**
0x0005	**REAL**
0x0006	**TON**
0x0007	**TOFF**
0x0008	**CTU**
0x0009	**CTD**
0x000A	**TP**

11.5 Enable type---

This is applicable when FB with enable is used by user.
Size- 1 byte

11.6 Enable—

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.7 Opcode---

This is the Opcode of Rung operation as per below table.
Size- 2 bytes

Instruction representation in OPCODE	Description
0x000x	AND
0x001x	OR
0x002x	XOR
0x003x	NOT
0x004x	ADD
0x005x	SUB
0x006x	MUL
0x007x	DIV
0x008x	MOD

0x009x	MOV
0x00Ax	SHL
0x00Bx	SHR
0x00Cx	ROR
0x00Dx	ROL
0x00Ex	MAX
0x00Fx	MIN
0x010x	LIMIT
0x011x	GT
0x012x	GE
0x013x	LT
0x014x	LE
0x015x	EQ
0X016X	NE
0x017x	Rising Edge
0x018x	Falling Edge
0x019x	CTU
0x01Ax	CTD
0x01Bx	0.01S TON
0x01Cx	0.1TON
0x01Dx	1s TON
0x01Ex	0.01S TOFF
0x01Fx	0.1TOFF
0x020x	1s TOFF
0x021x	0.01s TP
0x022x	0.1s TP
0x023x	1s TP
0x024x	RS
0x025x	SR

11.8 Type of operand 1---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.9 OP1---

Oprand 1

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.10 Type of operand 2---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.11 OP2---

Oprand 2

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.12 Type of operand 3---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.13 OP3---

Oprand 3

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.14 Type of operand 5---

Normal, Negation or Numeric—for logical instructions

Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.15 OP5---

Oprand 5

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.16 Type of operand 6---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.17 OP6---

Oprand 6

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.18 Type of operand 7---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.19 OP7---

Oprand 7

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.20 Type of operand 8---

Normal, Negation or Numeric—for logical instructions
Normal, Numeric—for other instructions
(same as XMPS-100)
Size- 1 byte

11.21 OP8---

Oprand 8

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.22 No. of Operand---

We have given max 8 address for any instruction.

User can use greater than 1 address for any instruction.

So for perticuler rung how many operands are used that count should be here.

11.23 T_C Name---

Timer Counter No.

We have limit the Max 255 all types of Timers & Max 255 all types of counters.

So according to this it will increase. And do not repeat.

11.24 Output1---

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

Size- 4 bytes

11.25 Output2---

Here actual MCU address will come….(after conversion of I1,Q0,F2 etc)

During compilation/ generate code command each address will convert into MCU address. (Check section xxx for more details)

This is right now applicable for Time 7 Counter instructions only.

Size- 4 bytes

11.26 EOF---

End of frame—"#"

After generation of Mcode for all backend rungs at last this character should add.

Size-1 byte

12.CPU address to MCU address conversion idea & base address:

Block No	*Type*	*Logical Address Range*	*Total nos PLC address*	*MCU Address starting Address*	*Next address ---*
0	Output address	Q0:000 to Q0:255	256	0X2001 C000	Plus 2
		Q0:000.00...Q0:000.15 to Q0:255.00…Q0:255.15	4096	0x2238 0000	Plus 4
1	Input adress	I1:000 to I1:255	256	0X2001 C200	Plus 2
		I1:000.00…I1:000.15 to I1:255.00…I1:255.15	4096	0X2238 4000	Plus 4
2	Flags (Memory bits)	F2.000 to F2.255	256	0x2238 8000	Plus 4
3	Status	S3:000 to S3:255	256	0x2001 C420	Plus 2
4	Integer Word	W4:000 to W4:255	256	0x2001 C620	Plus 2
5	Floating Point	P5:000 to P5:255	256	0x2001 C820	Plus 4
6	Timers	T6:000 to T6:255	256	0x2001 CC20	Plus 2
7	Counters	C7:000 to C7:255	256	0x2001 CE20	Plus 2
8	Reserved for future	X8.000 to X8.255	256	0x2001 D020	Plus 2
9	Reserved for future	Y9.000 to Y9.255	256	0x2001 D220	Plus 2
10	Auto memory flag	D10:000 to D10:2048	2048	0x223A8400	Plus 4