Profibus

,

.

.

,

.[1][2].

1980

.

MAP(Manufacturing
Automation Protocol)   [3][4].
MAP

.

,

OSI(Open Systems Interconnection)
reference model[5]   7

.

. 1980

.

,   IEC/ISA

                            Profibus   WorldFIP
[6][7].   Foundation
                    Fieldbus   .

    4~20mA
                                              ,
    .   CAN, Interbus
                            [8].   ,   ,

.

．

，   PC

，   IUC(Intelligent   Universal
                        ． ，   Controller)   Profibus
                                                                            , PC   IUC

                                        ,   CTask   OS-9   ．

        ．

                                ．

        ．

                                                                        ．

                                ．
                                                                ，
                Profibus   ．
FMS(Fieldbus Message Specification)
                        . Profibus
        ，
                                        ,   ，
                ，   ．
                                                                        Profibus

                                ．   ，
                                                        Profibus
                                                . Profibus

                ．   ，
Profibus   TRT(Target Rotation Time)
                                        [9],

                ．   ．

Profibus

,

.

. Profibus

. 32

, 3

. 127 . Profibus

Profibus Profibus 200m

FMS FMA7 500Kbps ,

. 1.5Mbps 12Mbps

.

,

Profibus

.

,

Profibus FDL(Fieldbus

, . Data Link Layer) ,

(medium access control)

. (logic link control) .

. Profibus

Profibus

[10]. . Profibus

Profibus -

.

. Profibus

,

[11][12],

.

Profibus

Profibus connectionless connection-oriented

. . Connectionless

broadcast multicast

, SDN (Send Data with No
Acknowledge) .
Connection-oriented service FMS

. FMS VFD(Virtual
Field Device) , OD(Object Directory)
SAP(Service Access Point) . , (context) , (variable) ,
(event) , (domain) ,
, SAP (program in-vocation) ,
. Connection-Oriented (access protection)
SDA(Send Data . FMA7(Profibus Management Layer 7)
with Acknowledge), SRD(Send and Request Profibus
Data with Reply), CSRD(Cyclic Send and .
Request Data With Reply) .

. FMA7
Profibus FMS(Profibus (local) (remote)
Message Specification), LLI(Lower Layer .
Interface) FMA7(Profibus Management FMA7
Application) [12]. FMS
, LLI . FMA7
FDL . (context-management)
FMA7 .

PDU(Protocol Data Unit) .

PDU . Profibus
. ,
( )
. Syntax .
Profibus ,
ISO ASN.1(Abstract Syntax Notation One)
[13][14].

.
FMS Profibus ,
. FMS OD(Object Dictionary) .

OD index .

PC ,

.

IUC(Intelligent Universal
. Profibus - Controller) Profibus

. PC IUC

. Profibus

CRL(Communication CTask OS-9 .

Relationship List) . 1 CTask PC

CR(Communication Reference) Profibus

CR , 2 OS-9

. IUC Profibus

Profibus .

. 1.PC Profibus

PC

,

. . PC

. **Profibus** [15][16]. Profibus

PC

. PC Profibus

,

. V25+

. CP5412P PC

, PLC, . V25+ 8088/86

NC , UART(Universal

Profibus Asynchronous Receiver Transmitter)

,

Profibus . , 20

. 1MB

. CP5412 16BitAT

PC , PC

Profibus 512Kbyte

. 64Kbyte Dual port RAM .

Profibus   9-pin D-sub

          . Profibus   SPC   .
ASIC   1.5Mbps   FMS   FMA7
          .

                                                                                          .
                         ,   Softing   FMS
                                          FMA7[18]
                         .   .

          .

Profibus
                    . PC
                    DOS

                         CTask   [17].
CTask

                    CPU
                    ,   1. FMS/FMA7
                         . ,   .
                              ,
                                   .   1
                                        .   FMS/FMA7   LLI
CTask   ,
     (resource),   (flag),   Description   Data   .
(mail box)   (pipe)   .   Description
                                                       .   comm_ref
Profibus   CR(Communication Reference)   CRL
                                             (,
                              SAP   )   . Layer
     .   Profibus   FMS   FMA7
                                        , service   FMS   FMA7

. Primitive   request,   void *data_ptr;
indication, response, confirmation   ,   // Data
                                                }

            primitive   .
Invoke_id   ID   , result   Write.req   Data
                                        ,
(positive)   (negative)   . Data   .

index   obj_code   typedef struct VAR_WRITE_REQ
OD   . LLI   Description   {
    Data   T_ACC_SPEC acc_spec; //
                    FDL   .   char subindex;
                                                //OD
                                        unsigned char length; //
                                        unsigned char value[length];
                                                        //
                                        }

                                profi_rcv_con_ind( )   ,
    2. Write   .   Description
                                            Data   .
    2   FMS
        Write   int profi_rcv_con_ind
                                    {
    .   Write   PROFI_SERVICE_DESCR FAR *sdb_ptr;
  primitive   // Description
    .   void *data_ptr;
        profi_snd_req_res( )   // Data
                Description   unsigned int *data_len;
            .   //
                                        }
Int profi_snd_req_res
{   Write   FMS
PROFI_SERVICE_DESCR FAR *sdb_ptr;
    // Description   ,   .

Description
Data   ,
transmit_req_res   .
transmit_req_res

, transmit_
req_res   Description
Data   PDU(Protocol Data
Unit)   ,

3. PC   FDL(Fieldbus Data Link)   .

.   Profibus

3 CTask

. Profibus

receive_cnf_ind, transmit_req_   .
res   FMS

.

receive_cnf_ind

description   Data
.

,

index_queue   . FMS
index_queue

, FMS

Description

application_index_queue   .   4. receive_cnf_ind

application_index_queue

4   receive_cnf_ind
,   . receive_cnf_ind

,
Data   ,   index_queue

.   ,   . receive_cnf_ind

FDL　　　　　confirm　　　indicate
primitive　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　.
　　　　　　　　　,　　　　　　　Description
　　Data　　　　　　　　　　　　　　　　　　　　　　　　　　,
　　　　　　　　　.　　　　　　　　　　　　　　　application_index_queue
　　index_queue　　　　　FMS
　　　　　　.　　　　　　　　　　　　　　　　　　　　　　　.

　　5. transmit_req_res　　　　　　　.

　　5　　transmit_req_res
. transmit_req_res

　　　　　　　　　　　.　　　　　　6. FMS　　　　　.
　　　　　　Description
　　　　　　　(　,　　　　　　　　7　　　　　　　　　　　　.
　　　　　　　)　　　.　　　　　　　application_index_queue
Data
　　　　FMS　　FMA 7　　　　　　　　　.
　　　　FDL
.　　　　　　　　　　　　　　Data

　　6　FMS　　　　　. FMS　　　　　　　　.
index_queue

　　　　　　　　　　　Description　　Data　　　　,
.　　　　　　　　　　　,　　　　　　transmit_req_res
　　　　Description　　　　　　　　.

SIB

, DTACK ,

. SIB

I/O

IDMA(Independent DMA) .

DPRAM(Dual Port RAM) CPU, CP, IDMA

. OS-

9 680x0

OS . OS-9

.

,

7. . , I/O

. ,

2. IUC Profibus I/O

.

embedded UNIX

. [21][22].

PEP

IUC OS-9 IUC CP

Profibus DPRAM

. IUC MC68302

IMP(Integrated Multiprotocol Processor) . PC .

. , PC

CXC I/O .

. IUC DMA

, 8 . PC

, DMA , 1152 receive_cnf_

dual port RAM , ind transmit_req_res FMS

SRAM EPROM .

[19]. MC68302

68000 core SIB(System Integration

Block) CP(Communication Processor) . receive_cnf_ind,

[20]. transmit_req_res, FMS

PC

8. OS-9

[9].

[23][24].

. Profibus

Target Rotation Time(TRT)

[9]. Profibus

(logical ring)

Real Rotation Time .

Profibus Real Rotation

Time Profibus .

TRT Real Rotation Time

.   .   9

Profibus

,   .

.

,   9.   .

.   1

,   2   .   ,   10

,   CP5412

3   PC   IUC   Write

.

.

1.

Profibus   .

1

,

.   1   bit time

Profibus   bit   ,

.   500Kbps

CP5412   1bit time   2 μsec   .

PC   3   IUC   1   Smart I/O

. Smart I/O   I/O

PLC   IUC   .   ,   , TRT

,   .

, CNC   PLC

PC, IUC   Smart I/O

Profibus   .

.

10.   .   ,   )
                                                                                               .

2.
Profibus   .
(event)

                                                              (discrete   event   first   token   passing   receive
system)   .   token

                                                                             receive token   .
SIMAN/ARENA[25]   Profibus   receive token
                                            .   Profibus

                                                                                                                                                     .
                              ,   , T_{RR} (Real
                                                                      Rotation   Time) T_{TR}(Target   Rotation
                                                                      Time)   . T_{RR} T_{TR}
                                          .

                                                                                                            .

                    ,   pass token
                                                                                      .

                                            [25].

                                                                                      transmit request frame
                                  Profibus   .

                                                              . transmit request frame

                                                                                              receive request frame
                    11   .   .
          (initialization)   1
                                                                                                                                    transmit
message   generation   ,   response   frame   ,
                    first token passing   transmit response frame
                              . message generation

                                                                      receive response frame
          (,   ,   ,   .

.

pass token

. T_{RR} T_{TR}

T_{TR}

,   11   1.

.

.

.

.   3.

Profibus

1

.   ,   ,

T_{RT} .

, T_{RT}

,   .

1

,

.

, T_{RT}

.

_____

12

200   , T_{RT}

1500 bit time

.   12

11.

.

13

. 500msec T_{RT} 15000 bit time

. ,

.

.

. .

. ,

.

.

,

.

12.

.

_____

14. T_{RT}

.

$\underline{T_{RT}}$ _____
14

500msec

13. 2

. T_{RT}

.   .

.   •

T_{RT} T_{RT}

.

1   .

T_{RT}

.   Profibus

T_{RT} T_{RT} .

.

.

_____

,

Profibus

.

Profibus

.

.   Profibus

•   Write   PC   IUC

,

.

CTask   OS- 9

.

.

Profibus

.   Profibus

.

Profibus

(safety factor)

,

.

,

T_{RT}(Target Rotation Timer)

Profibus

.

,

.

, Profibus

.

Profibus

, , NC PCL

,

.

,

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