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Cactus protocol for MORSE

version 8.08
1/11/2011

1. Introduction

The Cactus protocol transfers the data between Master PLC Cactus and the Slaves PLCs. Data is transferred to the radio channel without being modified and is checked using the checksum.

2. Data Format

The items are composed from the hexadecimal numbers coded in ASCII. E.g. the item 0x3744 represents the hex numbres 0x7D.

Data frame structure and the example:

```
| IDENT/16 | SERV/16 | DATA | CHS/16 | CR/8 |  
3744      3039      3030      3836      0D
```

IDENT/16 the Slave identity
SERV/16 the cactus service number
DATA data, the even number of data pairs
CHS/16 checksum
CR/8 end of frame, always 0x0D

Pooling call:

```
| IDENT/16 | CR/8 |  
3744      0D
```

Acknowledge:

```
| ACK/8 | CR/8 |  
21      0D
```

ACK/8 acknowledge, 0x21 represents the ! symbol

CR/8 end of frame, always 0x0D

No Acknowledge:

| NACK/8 | CR/8 |
3F 0D

NACK/8 nonacknowledge, 0x3F represents the ? symbol

CR/8 end of frame, always 0x0D

The checksum counting

The checksum is counted from the items IDENT, SERV and DATA. The process for all type of SERV except 0x1C:

Each byte of the frame represents one hex character according to ASCII table. The resulting hex characters in pairs are summed and the last two characters in ASCII form creates the checksum. Example:

3744 3039 3030 3836 0D ... the frame with the type SERV = 3039 = 0x09

$0x7D + 0x09 + 0x00 = 0x86$

0x86 in ASCII is 3836 and this is the CHS/16

The process for type SERV 0x1C:

The bytes are summed in this form which is in the frame. Last two characters of the result are expressed in ASCII:

3744 3143 4148 4F4A 3131 0D ... the type SERV = 3143 = 0x1C

$0x37 + 44 + 31 + 43 + 41 + 48 + 4F + 4A = 0x211 \rightarrow 0x11$

0x11 in ASCII is 3131 which is the CHS/16

3. Implementation in MORSE

The network arrangement.

```
CACTUS    CU 73112200                CU 7311227D    CACTUS 7D
MASTER --- RADIOSLAVE ..... RADIOMASTER --- SLAVE
          :
          :          CU 7311227E    CACTUS 7E
          : ..... RADIOMASTER --- SLAVE
```

The PLC Cactus Master is connected by vires to the MORSE CU Radioslave which has the MORSE address ending with 0x00.

The PLC Cactus Slave having the identity e.g. 0x7D is connected to the CU Radiomaster. It uses the MORSE address ending with the same characters 0x7D. The higher part of MORSE address is the same as at CU Radioslave.

The traffic possibility:

Pooling in the quiet state

Master PLC sends the pooling call to the PLC Slave and it answers:

```
MASTER PLC      SLAVE PLC
0x37440D  -->  0x37440D
0x37440D  <--  0x37440D
```

Request from MASTER and response from SLAVE

SLAVE PLC sends data only after request:

```
MASTER PLC      SLAVE PLC
0x37440D        -->  0x37440D
0x37443039303038360D <--  0x37443039303038360D
0x210D         -->  0x210D
```

RADIO SLAVE CU remembers the SLAVE identity after receiving the dataframe from SLAVE PLC to be able send the ACK from MASTER PLC to the appropriate SLAVE PLC. Only one ACK can be sent.

Data from MASTER

MASTER PLC can transmit spontaneously:

```
MASTER PLC      SLAVE PLC
0x37443039303038360D -->  0x37443039303038360D
0x210D          <--  0x210D
```

Example with the SERV type 0x1C:

```
MASTER PLC      SLAVE PLC
0x3744314341484F4A31310D -->  0x3744314341484F4A31310D
0x210D          <--  0x210D
```

3.1. Communication example

The RADIO SLAVE transmits the frame to the RADIO MASTER and received ACK:

```
>>
15:13:17.890 rxsim  9 | S02
3744 3039 3030 3836 0D
15:13:17.891|          |7311227D 73112200|S02I  OUT  9||89 2usr  0
3744 3039 3030 3836 0D

15:13:18.189|          |73112200 7311227D|S02I  IN   2|*09 6usr  0
210D
15:13:18.189 tx    2 | S02
210D
```

The RADIO MASTER received the frame from RADIO SLAVE and transmits the ACK:

```
>>
15:13:17.977|          |7311227D 73112200|S02I  IN   9|*89 2usr  0
```

```
3744 3039 3030 3836 0D
```

```
15:13:17.977 tx      9 | S02
```

```
3744 3039 3030 3836 0D
```

```
15:13:18.152 rxsim   2 | S02
```

```
210D
```

```
15:13:18.152|          |73112200 7311227D|S02I  OUT   2||09 6usr  0
```

```
210D
```

4. Configuration Parameters

```
PLC Master - CU RADIOSLAVE ... CU RADIOMASTER - Slave PLC
```

```
(m)ode:RADIOMASTER (wired to slave)
```

```
Center (a)ddr:2200
```

```
Max (g)ap:20ms
```

```
(q)uit
```

```
>>
```

(m)ode m - RADIOMASTER - CU wired to the PLC SLAVE

 s - RADIOSLAVE - CU wired to the PLC MASTER

Center (a)ddr down part of the RADIOSLAVE MORSE address, only RADIOMASTER uses this parameter

Max (g)ap 15 to 40ms recommended, max. possible interrupting inside incoming frame on wires. After longer break is the data regarded as a new frame.



Note

When MASTER sends the frame to the identity address 00, the the Cactus protocol in the RADIOSLAVE transmits it as broadcast. The broadcast setting must be prepared for this. It is used for network tuning purposes only.

5. History

807 - 02/2007 - protocol created

808 - 03/2007 - the parameters corrected to the state:

Cactus MASTER - CU RADIOSLAVE --- CU RADIOMASTER - Cactus SLAVE

10.0.96.0 - 02/2010 - (N)ACK addressed added - more on support@racom.eu