Telecommunications - X.25 frame types

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Frame Types

I Frame (modulo 8)

A	N(R) P N(S) 0 F even no	I field	FCS

I Frame (modulo 128)

A	N((R) 0	P N(R)	I field	FCS

RR Frame (modulo 8)

A	N(R) P 0001 F N1	FCS

RR Frame (modulo 128)

A	00000001 01	P N(r) F	FCS

RNR Frame (modulo 8)

A	N(R) P 0101 F N5	FCS

RNR Frame (modulo 128)

A	00000101 05	P N(r) F	FCS

REJ Frame (modulo 8)

A	N(R) P 1001 F N9	FCS

REJ Frame (modulo 128)

A	00001001 09	P N(r) F	FCS

SABM

A	001 P 1111 F 2F / 3F	FCS

SABME

A	011 P 1111 F 6F / 7F	FCS

SARM

A	000 P 1111 0F / 1F	FCS

DM

A	000 F 1111 0F / 1F	FCS

DISC

A	010 P 0011 43 / 53	FCS

UA

A	011 F 0011 63 / 73	FCS

FRMR / CMDR

A	100 F 0111 87 / 97	rejected frame control field	0 V(S) c/r V(R)	W X Y Z 0 0 0 0	FCS

I Information frame

I Frame (modulo 8)

1 byte	1 byte		
Address	Control	I field	FCS

bit: 8 7 6 5 4 3 2 1
value N(R) P N(S) 0
               F

I frame is allways an
even number

	Command DCE to DTE	Command DTE to DCE	Response DCE to DTE	Response DTE to DCE
single link operation	A = 03	B = 01	B = 01	A = 03
multi link operation	C = 0F	D = 07	D = 07	C = 0F

I Frame (modulo 128)

1 byte	2 bytes		
Address	Control	I field	FCS

bit: 8 7 6 5 4 3 2 1
value N(S)   0

bit: 8 7 6 5 4 3 2 1
value N(R)   P
                  F

first byte of I frame
is allways an
even number

I frames are numbered. The N(S) count provides for numbering the frame being sent and the N(r) provides acknowledgement for the I frames received. When duplex information exchange is in continual process, each station reports its current N(s) and/or N(r) counts in each I or S frame exchanged.

Supervisory frames

RR - Receive Ready

RR Frame (modulo 8)

Address	Control	FCS

1 byte | 1 byte

bit: 8 7 6 5 4 3 2 1
value N(R) P 000 1
              F

hex = N1

RR Frame (modulo 128)

Address	Control	FCS

1 byte | 2 bytes

bit: 8 7 6 5 4 3 2 1   bit: 8 7 6 5 4 3 2 1
value 0 0 0 0 0 0 0 1   value N(R)   P
                                                  F

	Command DCE to DTE	Command DTE to DCE	Response DCE to DTE	Response DTE to DCE
single link operation	A = 03	B = 01	B = 01	A = 03
multi link operation	C = 0F	D = 07	D = 07	C = 0F

The RR frame confirms numbered I frames upto N(R)-1 and indicates that the originating station is ready to receive.

An RR can be sent as a response to an I frame.

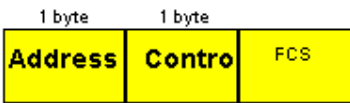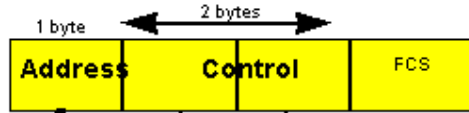An RR can also be sent as a command to 'poll' the other end of the link.

RR as a response

------ I -------->

<----- RR --------

Command RR

------ RR P ------>

<----- RR P -------
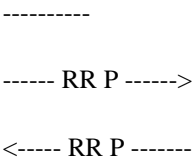
RNR - Receive Not Ready

RNR Frame (modulo 8)

| 1 byte | 1 byte | |
| Address | Control | FCS |

RNR Frame (modulo 128)

| 1 byte | 2 bytes | |
| Address | Control | FCS |

bit: 8 7 6 5 4 3 2 1
value 0 0 0 0 0 1 0 1

bit: 8 7 6 5 4 3 2 1
value N(R)   P
                     F

bit: 8 7 6 5 4 3 2 1
value N(R) P 010 1
                F

hex = N5

	Command DCE to DTE	Command DTE to DCE	Response DCE to DTE	Response DTE to DCE
single link operation	A = 03	B = 01	B = 01	A = 03
multi link operation	C = 0F	D = 07	D = 07	C = 0F

The RNR frame confirms numbered I frames upto N(R)-1 and it also indicates a temporarily busy condition due to buffering or other internal constraints.

<----- I -------

------ RNR ---->

busy on

this end should not send any more I frames
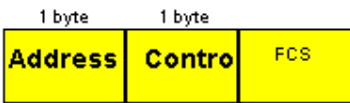
------ RR ----->

busy off

this end free to send I frames again

due to a bug in Public Network, if busy is put on with RNR with P-bit=0 it

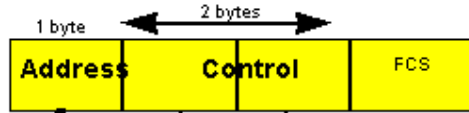cannot be put off again with P-bit=1.

slide REJ

REJ - Reject

REJ Frame (modulo 8)

1 byte	1 byte	
Address	Control	FCS

bit: 8 7 6 5 4 3 2 1
value N(R) P 1 0 0   1
              F

hex = N9

REJ Frame (modulo 128)

1 byte	2 bytes		
Address	Control		FCS

bit: 8 7 6 5 4 3 2 1   bit: 8 7 6 5 4 3 2 1
value 0 0 0 0 1 0 0 1   value N(R)   P
                                                  F

	Command DCE to DTE	Command DTE to DCE	Response DCE to DTE	Response DTE to DCE
single link operation	A = 03	B = 01	B = 01	A = 03
multi link operation	C = 0F	D = 07	D = 07	C = 0F

This command/response may be transmitted to request transmission or retransmission of numbered information frames. REJ confirms frames through N(R)-1 and requests the retransmission of numbered information frames starting at the N(R) contained in the REJ frame.

```
<--- I N(s)=5 ---
                                        I frame 6 is lost perhaps due to noise
<--- I N(s)=7 ---
---- REJ N(R)=6 -->                     confirms frames upto 5 requests retransmission of 6
<--- I N(s)=6
```

Unumbered format frames

SARM set asynchronous response mode

SARM

Address	Control	FCS

1 byte | 1 byte

bit: 8 7 6 5 4 3 2 1
value 0 0 0 P 1 1 1 1

hex = 0F / 1F

	Command DCE to DTE	Command DTE to DCE
single link operation	A = 03	B = 03
multi link operation	C = 0F	D = 07

asynchronous response mode (ARM) was used in the early days of X.25 now being phased out.

Sets asynchronous response mode - brings the link up in one direction. So to bring the link up fully requires an exchange in both directions as follows:

------ SARM ------>

<----- UA ---------

<----- SARM -------

------ UA -------->

SABM set asynchronous balanced mode

SABM

	1 byte	1 byte	
	Address	**Control**	FCS

bit: 8 7 6 5 4 3 2 1
value 0 0 1 P 1 1 1 1

hex = 2F / 3F

	Command DCE to DTE	Command DTE to DCE
single link operation	A = 03	B = 01
multi link operation	C = 0F	D = 07

the SABM can be sent by either end of the link to place the link in asynchronous balanced mode. If the link is already in ABM a SABM-UA exchange can be used to reset the sequence numbers and to clear any RNR busy condition any previously transmitted I frames that are unacknowledged remain unacknowledged.
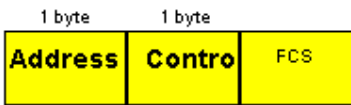
assume link is down

----- SABM ------>

<---- UA ---------

link is now up

In theory either end could bring the link up, in practice Public Network always leaves it to the DTE to bring the link up, this is because Public Network does not know if the DTE wants to use ABM or ARM.

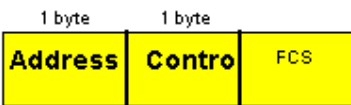---

SABME set asynchronous balanced mode extended

SABME

bit: 8 7 6 5 4 3 2 1
value 0 1 1 P 1 1 1 1

hex = 6F / 7F

	Command DCE to DTE	Command DTE to DCE
single link operation	A = 03	B = 01
multi link operation	C = 0F	D = 07

as for SABM but starts modulo 128 operation - not used on Public Network.

DISC - Disconnect command

DISC

bit: 8 7 6 5 4 3 2 1
value 0 1 0 F 0 0 1 1

hex = 43 / 53

	Response DCE to DTE	Response DTE to DCE
single link operation	B = 01	A = 03
multi link operation	D = 07	C = 0F

The Disc command can be used by any end of the link to terminate the mode previously set and to put the link into the down state.

assume link up

<--- DISC ---------

---- UA ---------->

link is now down

In Public Network the DISC frame is also used by the [network](#) to poll the DTE when the link is in the down state.

```
 DTE                                                          DCE

              <--- DISC -----
              <--- DISC P ---
              <--- DISC P ---
              <--- DISC P ---

                                                the network will continue
                                                polling until the DTE
                                                responds with a UA the
              ---- UA P ---->                   network will then wait for the
                                                DTE to bring the link up with
                                                a SARM or a SABM
```
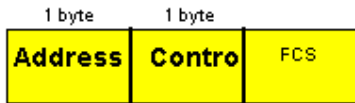

UA - Unnumbered acknowledgment response

UA

	1 byte	1 byte	
	Address	**Contro**	FCS

bit: 8 7 6 5 4 3 2 1
value 0 1 1 F 0 0 1 1

hex = 63 / 73

	Response DCE to DTE	Response DTE to DCE
single link operation	B = 01	A = 03
multi link operation	D = 07	C = 0F

The UA unnumbered response is used by the DTE to acknowledge the receipt and acceptance of the SABM/SABME and DISC unnumbered commands. Received SABM/SABME and DISC unnumbered commands are not actioned until the UA response is transmitted.

DM - Disconnected mode Response

DM

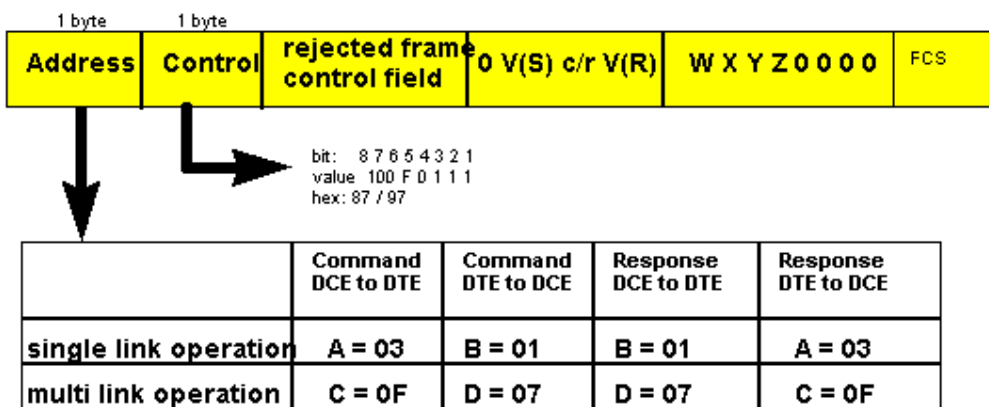|	Response DCE to DTE	Response DTE to DCE
single link operation	B = 01	A = 03
multi link operation	D = 07	C = 0F
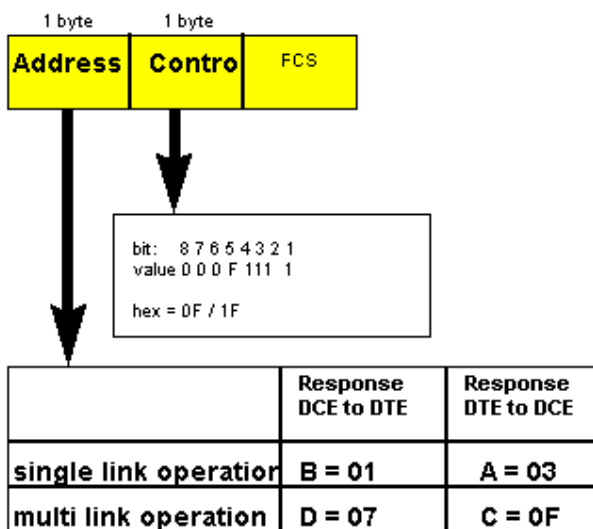
The DM response is used to report a status where the sender is logically disconnected from the link, and is in the disconnected phase. The DM response may be sent in this phase to request a set mode command, or, if sent in response to the reception of a set mode command, to inform the remote end that the sender is still in the disconnected phase and cannot action the set mode command.

Command With P bit set	DM
Command without P bit set	ignore
SABM	UA or DM

In Public Network if DM sent in response to polling discs, polling is stopped for T3=T1 * N2

FRMR - frame reject response

FRMR / CMDR

	Command DCE to DTE	Command DTE to DCE	Response DCE to DTE	Response DTE to DCE
single link operation	A = 03	B = 01	B = 01	A = 03
multi link operation	C = 0F	D = 07	D = 07	C = 0F

This response is transmitted when it receives an invalid frame other than bad FCS which are ignored or N(S) errors - REJ

A received frame may be invalid for several reasons:

- its Control field is not implemented at the receiving station. This category includes unassigned commands.
- the information field is too long to fit the receiving station buffers
- The Control field in the received frame does not allow an I field to be received with the frame.
- The N(r) that was received from the primary station is invalid.

metadata block	
see also:	
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