b. When transmitting a message through a transmission medium, the equipment which receives the message should first find out whether it has received the message correctly. If there is an error the receive station should be able to correct the error either by the information available in the error control field or requesting the transmitter to retransmit the message again. In any case the message K2 to be introduced an additional field named Error Control. Hence message K2 will be evolved to message K3 to accommodate the error control field to a complete message.

Error Control Techniques adopted for Common Channel Signaling

Chapter 2

2.1 Function of Error Control Field

Error Control field should be capable of achieving whether there are any errors in message K3 and if there is an error how to correct it? There are two methods. They are

Forward Error Correction
Backward Error Correction

In the Forward error correction the error control field is powerful enough to detect an error and correct it. The examples of such kind of codes are Hamming Code and Convolution Code and mainly implemented in uni-directional transmission such as TV and Radio Broadcasting as well as in real time transmission such as voice. In this case a High bandwidth is required since the error control field will be very much comparable to the message K3.

In the Backward error correction the error controlled field will have two major sub fields i.e.

Error detection sub-field
Sequence Control sub-field

This method is deployed only in bi-directional communication where the information is not real time.

2.2 Backward error detection Codes

The examples of Backward error detection codes are given below

(a)	Parity check	-	append a bit to make number of is in the message odd of even. This is used for short messages.
(b)	Block parity check	-	Row and column separate parities will result in a block party.
(c)	Cyclic Redundancy	-	Decide the noise characteristics and derive a polynomial. According to the polynomial decide upon the CRC code to be appended to the message.

This is good for long messages and hence CCITT No 7 uses Cyclic Redundancy Code for error detection. Polynomial used is,

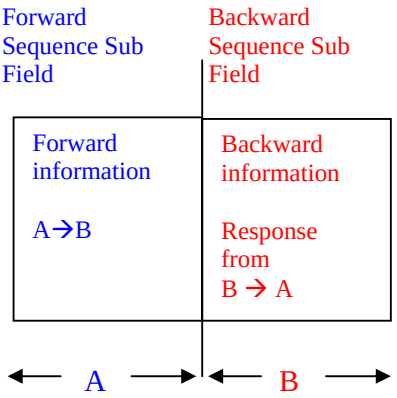
$$x^{16} + x^{12} + x^5 + x^0 = p(x)$$

Hence CRC of 16 bits in the case of No 7 signaling will be appended to the message of error detection. (For more details see the chapter on Error Control).

Voice calls involve two major activities namely signaling (to connect A to B) and speech (allowing two customers to speak). For error control, this can be treated in two different ways, since signaling is before to speech and can accommodate appreciable delays when compared to voice. For that matter signaling of CCITT No. 7 or any data call deploys Backward Error Correction.

2.3 Backward Error Correction and Operation of Sequence Control Field

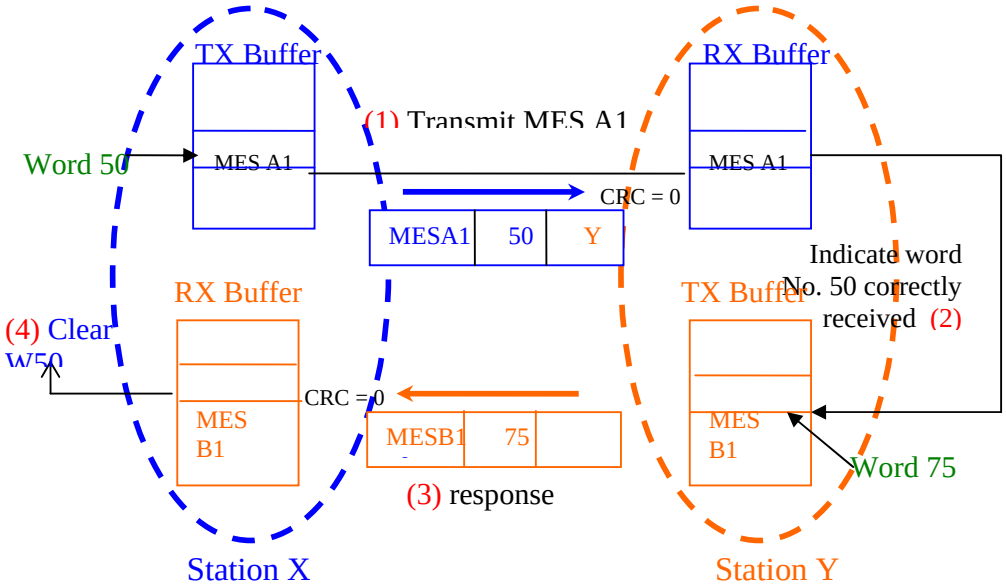
The sequence control field deploys two further subfields pertaining to the information with regard to the message being transmitted and the response information with regard to the messages received from the other station



This will necessitate to have a transmit buffer as well as a receive buffer in a given station. This requires the sequence control field to be filled with the following information.

(i) Message number of the transmitted message
(ii) Response to the forward message received from the receiver

Example



MES A1 =

CRC	50	Y	LI	SIO	Label	INS	Data

The Following major functionalities observed from the above transaction.

1. There are two stations namely Station X and Station Y interconnected with two transmission media of 64 kbps from X to Y and Y to X (bi-directional transmission).
2. A message generated from Station X to be transmitted to Station Y over the 64 kbps data link from Station X to Station Y. Say MES A1.
3. This message MES A1 is stored at the word number 50 of the transmit buffer at Station X.
4. The information in word 50 will be sent over the transmission media with the sequence control field of | 50 | Y | where the sub field 50 indicates Forward sequence number pertaining to MESA1 and Y is the Backward Sequence number responding to a message received from Station Y.
5. Assume CRC = 0 hence MES A1 has been correctly received at Station Y and stored in the received buffer.
6. The Receive Buffer filter the Sequence control sub field the value 50 and inform this value to the Transmit Buffer at Station Y so that when Station Y is sending a message stored in word 75 the response sequence control sub field will be filled with 50.
7. The information in word 75 will be sent over the transmission media with the sequence control field of | 75 | 50 | where the sub field 50 the Backward Sequence number responding to a message received from Station X.
8. Assume CRC = 0 hence MES B1 has been correctly received at Station X and stored in the received buffer. It will filter the Backward Sequence number 50 and inform the Transmit Buffer to clear the contents of word 50.

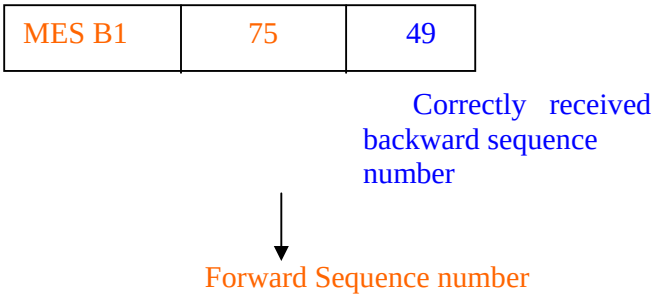
The above process is explained in order to identify how a message is being transmitted from one station to another station. Similar process exists in the reverse direction from Station Y to Station X.

Hence there are 4 basic phases involved in sending a message correctly.

(1) Transmit with the forward sequence number at A.
(2) Received correctly the message with CRC=0 at B, and pass the information to the transmit buffer at B, to fill the backward sequence number to indicate that the message is correctly received.
(3) A message MES B1 (no relation to MES A1) is correctly received by A. Then the received buffer send a message to clear word No.50 of the transmit buffer.
(4) Clear the word number 50 from the transmit buffer.

When the transmission introduce errors

What will happen if an error is detected? Say word No. 50 (i.e. MES A1) transmitted from station A is in error. (Assume word No.49 of station A is received correctly by B). Then word no.75 (i.e.MES B1) of station B will be sent as follows.



2.4 Formation of CRC

CRC will be formed just before a message is going to be sent to the transmission media. Hence MES B1 and Sequence control field both forward and backward will be used to identify the CRC.