516-10, -11, -18
DRW
2/7/69

RING FORMATS

A. This replaces 516-10, -11 and -18.

I/O commands between DDP-516 and the computer interface are as follows:

Machine Code	OP Code Mnemonic	Octal Code	Text MS 1 - - - 8 (I/O Lines)	Text 9 - - - LS 16 (I/O Lines)	
OTA	WHRG	740243	Not Used	Header	Write Header to Ring
OTA	WDRG	740244	High Order Data	Low Order Data	Write Data to Ring and go
INA	RDRG	540444	High Order Data	Low Order Data	Read Data from Ring
INA	RHRG	540443	Status	Header	Read Header from Ring and go.

Header format for the ring is as follows:

1. 6 bits H_1 thru H_6 describe 64 Node addresses

   H_1 is the LS bits of the Ring address and is on I/O bus 14.

   H_6 is the MS bit of the Ring address as is I/O bus 9.

2. 2 bits of Operation Code.

   a. OP_1 is the LS bit of the Operation Code and is on I/O bus 16.

   b. OP_2 is the MS bit of the Operation Code and is on the I/O bus 15.

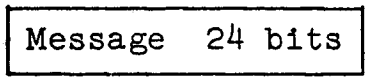
c.

OP_1	OP_2	
0	0	Write Command to Device
1	0	Read Status from Device
0	1	Write Data to Device
1	1	Read Data from Device

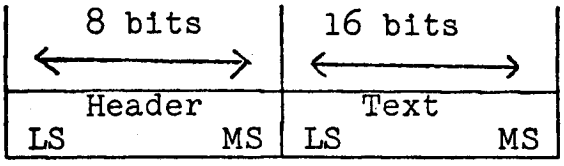
3. The text follows the Header to the Computer Ring Sending Interface "CRSI" and the interface sends the message "Header plus the text", the least significant being sent first. It is assumed no other messages will be sent until the computer reads a message via a INA loop or an I/O interrupt. Once a complete message has been received by the Computer Ring Receiver Interface, "CRRI", a ring receiving interrupt flag is set. The Computer Ring Interface, "CRI", has its own status, one of the bits in the status is the Interrupt Ring Receiving Flag, "IRRF". This allows, once the message has been sent, the program in the 516 to either sit in a loop reading status until the "IRRF" is a one, or work through the normal interrupt features of the 516.

B. The computer transmits a message on a ring (a coaxial cable), to a node on the ring. Each node has a repeater or equivalent in which to receive or send messages. All messages are originated by the computer by the following format arrangement.

A message consisting of 24 bits is sent or received by the computer.



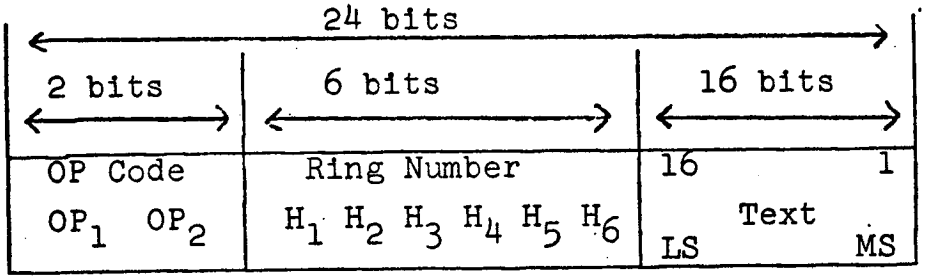
A message consisting of 8 bits of header and 16 bits of text



The computer normally addresses the node by its ring which is 6 bits. The first 2 bits of the header is an operation code for the node to decode for each message.

The formats are as follows:

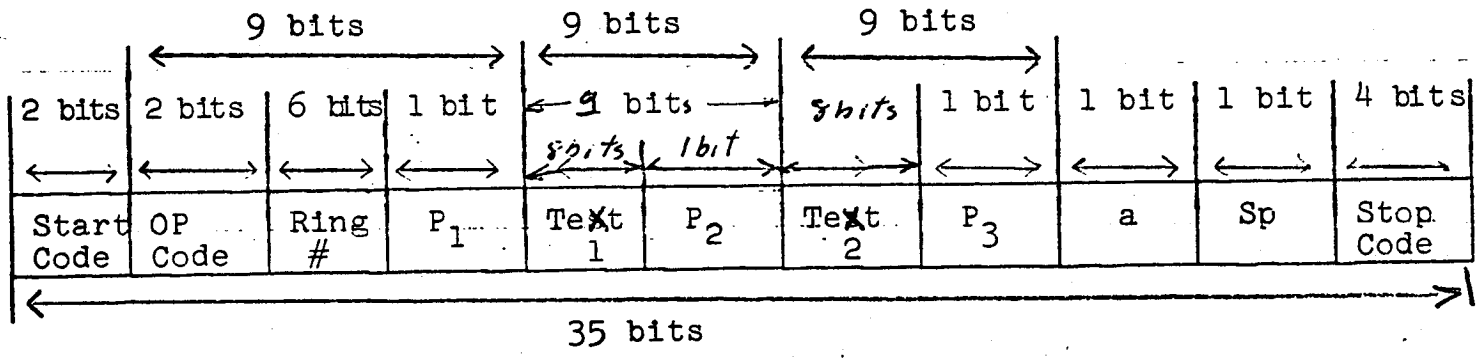
Computer Sending Format - "CSF"



1. ring # is the node address.
2. OP code is the operation code for the node that is addressed.

   OP code (OP2 OP1)
   00 Write Command
   01 Read Status
   10 Write Data
   11 Read Data

Computer Sending Interfacc Format - "CSIF"



created by the CSIF are:

Write	P_1, P_2, P_3	odd
Read	P_1	odd
	P_2, P_3	zero

a = Acknowledge bit, sent as a zero

Sp = Spare, sent as a zero

Computer Receiving Interface Format - "CRIF"

Same as CSIF with the exceptions:

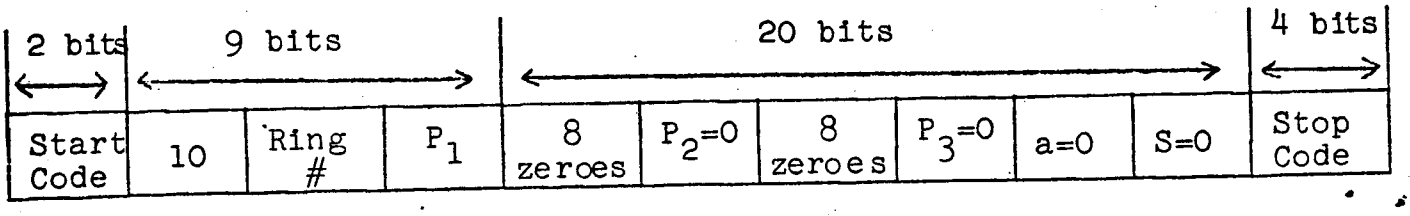
a = 1 the acknowledge bit set to one means that addressed node received the message and accepted it without parity errors.

a = 0 the acknowledge bit set to a zero means the addressed node ignored the message.

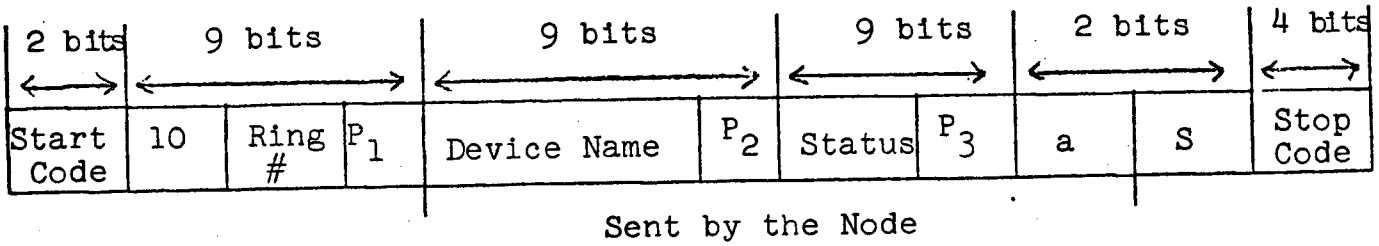
Detailed CSIF and CRIF are as follows:

1. Read Status from the Device "10" is to find the various statuses of the nodes.

CSIF



CRIF



a. Device Name is an eight-bit number which tells what type of device is plugged into the node interface.

b. Status is eight bits that can tell the computer the major status conditions of the device on the node.

c. P_2 and P_3 are odd parity generated from the new text and sent by the node.

d. a = 1 message accepted by the node.
a = 0 message ignored by the node.

e. Sp = 0.

2. Write Command to the Device "00" is write statement from the computer to control the device into various modes of operation

CSIF

2 bits	9 bits			9 bits		9 bits		2 bits		4 bits
Start Code	00	Ring #	P_1	Control 1st 8 bits	P_2	Control 2nd 8 bits	P_3	a	Sp	Stop Code

CRIF

2 bits	9 bits			9 bits		9 bits		2 bits		4 bits
Start Code	00	Ring #	P_1	Control 1st 8 bits	P_2	Control 2nd 8 bits	P_3	a	Sp	Stop

a = 1 "node accepted message"
a = 0 "node ignored message"

3. Read Data "11" is to read data from an addressed node.

CSIF

2 bits	9 bits			9 bits		9 bits		2 bits		4 bits
Start Code	11	Ring #	P_1	8 zeroes	P_2=0	8 zeroes	P_3=0	a=0	Sp=0	Stop

CRIF

2 bits	9 bits			9 bits		9 bits		2 bits		4 bits
Start Code	11	Ring #	P_1	Data 1st 8 bits	P_2	Data 2nd 8 bits	P_3	a	Sp	Stop Code

a. data is sent by the addressed node.

b. P_1 and P_2 is odd parity created from the data by the node.

c. a = 1 message accepted by the node.
a = 0 message ignored by the node.

4. Write Data "01" is a write message from the computer in which the text contains data to an addressed node.

CSIF

2 bits	9 bits			9 bits		9 bits		2 bits		4 bits
Start Code	01	Ring #	P_1	Data 1st 8 bits	P_2	Data 2nd 8 bits	P_3	a	Sp	Stop Code

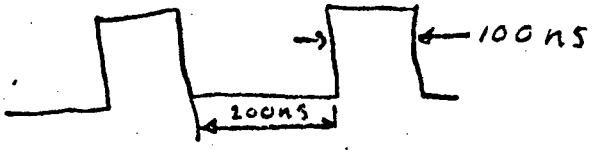
CRIF

2 bits	27 bits					
Start Code	01	Ring #	P_h	Data	P_t	a

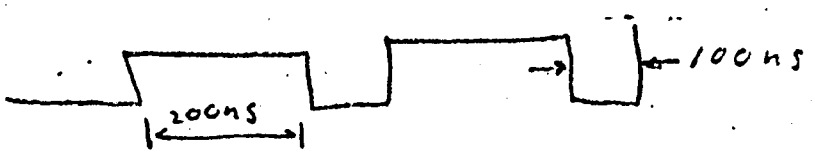
a = 1 message accepted by the node.
a = 0 message ignored by the node.

C. Four types of codes are used on the ring, they are as follows:

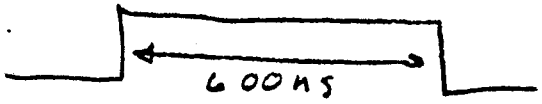
1. zeroes



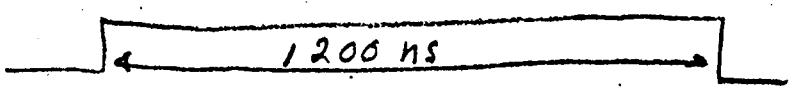
2. Ones



3. Start Code



4. Stop Code

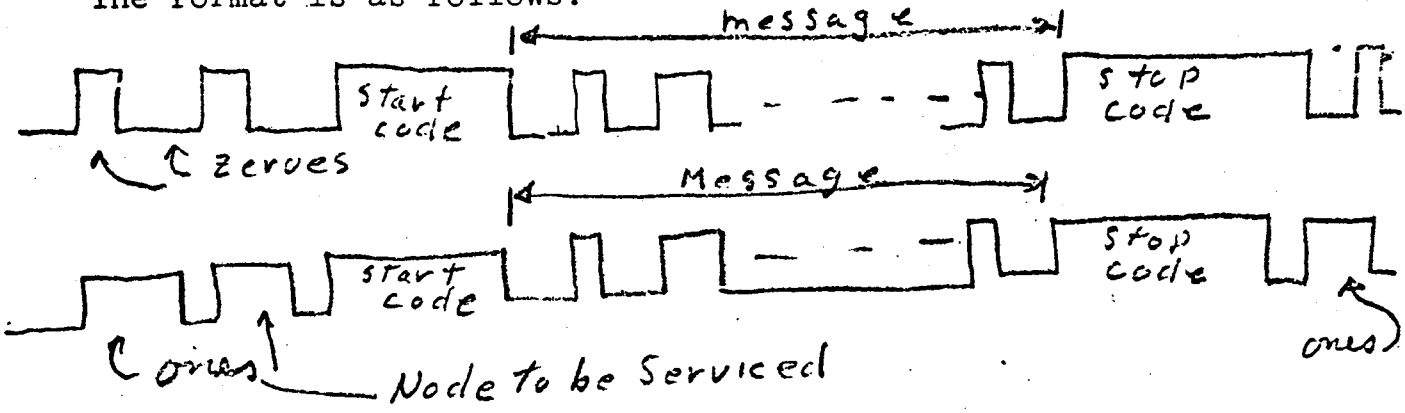


Zeroes are sent by the CRSI between messages.

D. Format for Ring Interrupt

Interrupts will occur from the ring to the computer from the Node Modem which needs to be serviced. A minimum of two zeroes are sent between messages. The Node Modem logic will insert a one between messages if its device interrupt flag is up. An Alarm message is sent from the computer and requires the Node Modem to report its ring # via a time slot in the text (Ring Time Slot "RTS" if its device interrupt flag is up.

The format is as follows:



ALARM FORMAT

	Header			Text						
Start Code	Ring # 000000	OP Code	P_1	1st 8 time slots	P_2	2nd 8 time slots	P_3	A	S_p	Stop Code

Alarm code

00	1st 16 Nodes I flag time slots.
01	2nd " " " " " "
10	3rd " " " " " "
11	4th " " " " " "

If the [illegible] 000000 01 and the 6th node of the 2nd section of 16 [illegible] Interrupt flag set, that node will insert a one into the [illegible] slot of the text. Any message for the addressed Node will reset the Interrupt flag of the Node.

The operation of Interrupt from a Node Modem on the ring is as follows:

1. Insert ones between messages.
2. On a "Alarm" message from the computer put a "one" in the proper time slot of the text.
3. At the node a RFS message is received from the computer, insert the Device number and the Device status in the text of the message.
4. The Interrupt flag is only created by the device. It is up to the device logic to bring down its own Interrupt line to the Node.

The status of the "CRI" is as follows:

	Status	Computer Input Bus
1.	P_1 (Parity)	8
2.	P_2 "	7
3.	P_3	6
4.	Acknowledge	5
5.	Alarm Flag	4

This sets the Ring Interrupt flip-flop
resets: when ring status is read (RHRG) or Master Clear
Sets: if any device needs service.

6.	Stop Single Shot	3

One if ring is in operation
Zero when ring is inoperative.

7.	Start Stop Flip-Flop	2

One = message is being received
Zero = message not being received.

8.	Interrupt [illegible]	1

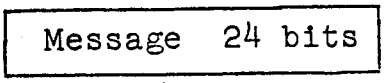
One = end message or alarm FF set
Zero = master clear, read data or read header

The CRI logic is attached.

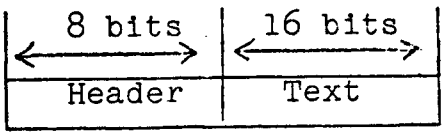
516-11
DRW
7/16/68

The computer transmits a message on a ring (a coaxial cable) to a node on the ring. Each node has a directional coupler or equivalent in which to receive or send messages. All messages are originated by the computer by the following format arrangement.

A message consisting of 24 bits is sent by the computer



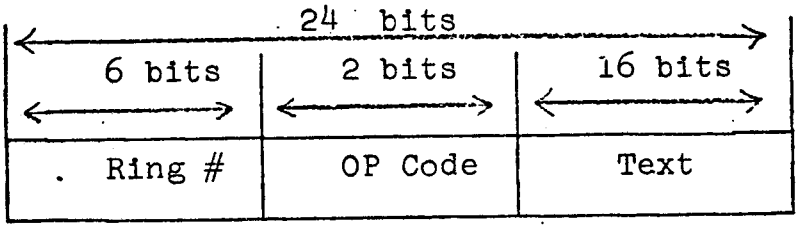
A message consisting of 8 bits of header and 16 bits of text



The computer normally addresses the node by its ring which is 6 bits. The last 2 bits of the header is an operation code for the node to decode for each message.

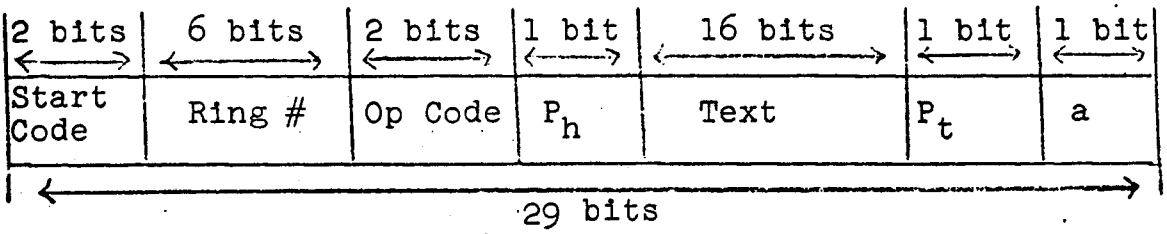
The formats are as follows:

Computer Sending Format - "CSF"



1. ring # is the node address.
2. OP code is the operation code for the node that is addressed.
   OP code 00 Request for status.
   01 Command out.
   10 Read data.
   11 Write data.
3. If the ring # is all zeroes the "00" OP code then means a call for a "request for service" from nodes on the ring. Any node may reply by having its interrupt flag up. (See formats under "Request for Service.)

Computer Sending Interface Format - "CSIF"



created by the CSIF are:

P_h = Header parity (odd)
P_t = Text parity (odd)
a = Acknowledge bit, sent as a zero

Computer Receiving Interface Format - "CRIF"

Same as CSIF with the exceptions:

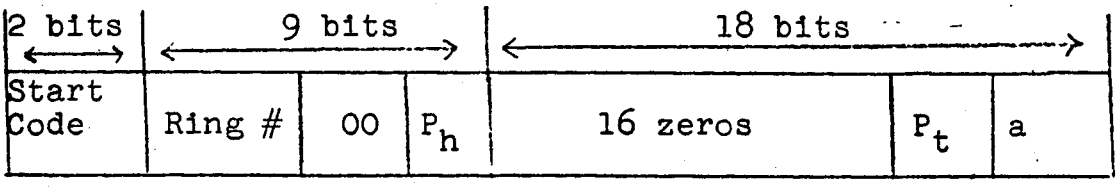
a = 1 the acknowledge bit set to one means the addressed node received the message and accepted it without parity errors.

a = 0 the acknowledge bit set to a zero means the addressed node ignored the message.

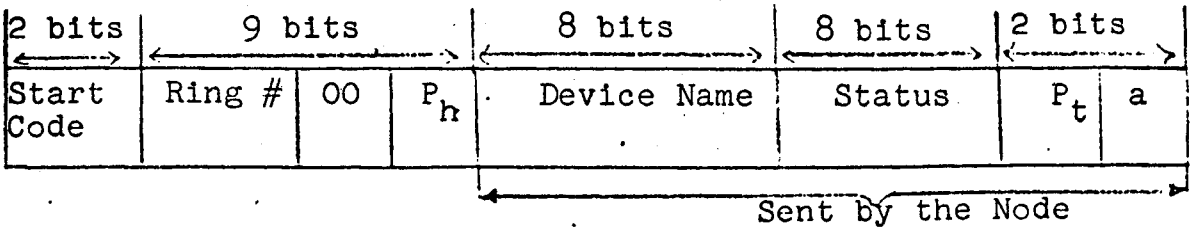
Detailed CSIF and CRIF are as follows:

1. Request for Status "00", is to find the various statuses of the nodes.

CSIF



CRIF



a. Device Name is an eight-bit number which tells what type of device is plugged into the node interface.

b. Status is eight bits that can tell the computer its major status conditions.

c. P_t is recreated from the new text and sent by the node.

d. a = 1 message accepted by the node.
a = 0 message ignored by the node.

2. Command out "01" is write statement from the computer to control the nodes into various modes of operation.

CSIF

2 bits	9 bits			16 bits	2 bits	
Start Code	Ring #	01	P_h	Control word	P_t	a

CRIF

2 bits	9 bits			18 bits		
Start Code	Ring #	01	P_h	Control word	P_t	a

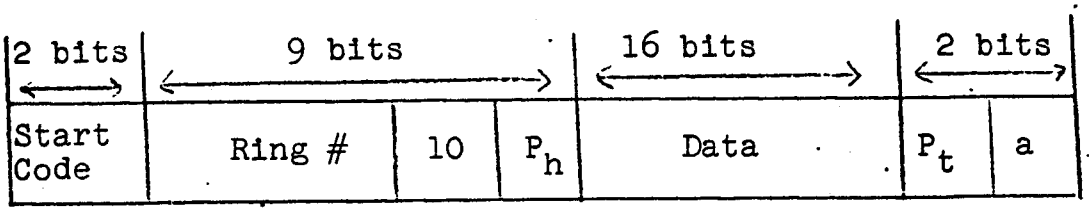
a = 1 "node accepted message"
a = 0 "node ignored message"

3. Read Data "10" is to read data from an addressed node.

CSIF

2 bits	9 bits			16 bits	2 bits	
Start Code	Ring #	10	P_h	Zeros	P_t	a

CRIF



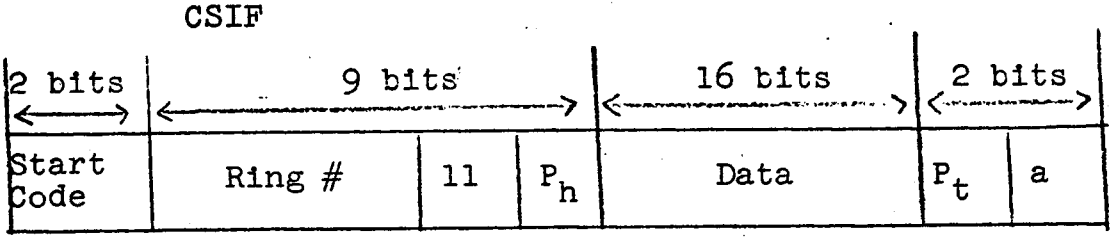
a. data is sent by the addressed node.

b. P_t is created from the data by the node.

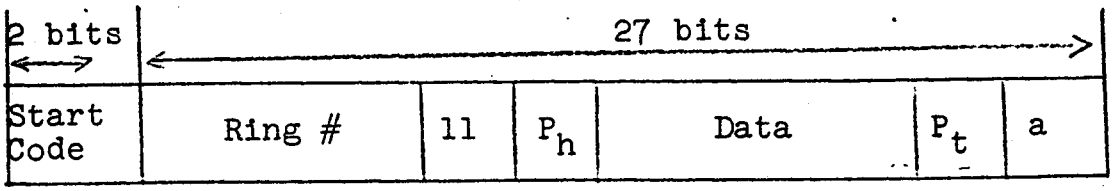
c. a = 1 message accepted by the node.
a = 0 message ignored by the node.

4. Write Data "11" is a write message from the computer in which the text contains data to an addressed node.

CSIF



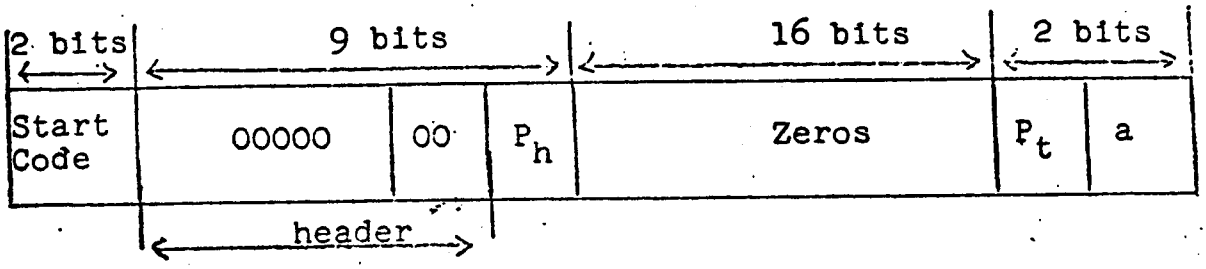
CRIF



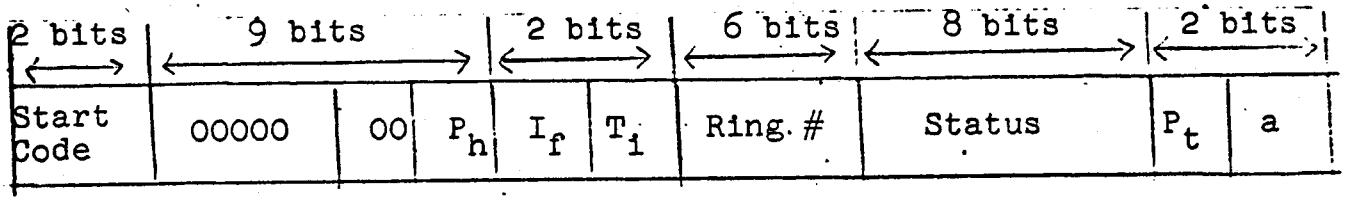
a = 1 message accepted by the node.
a = 0 message ignored by the node.

5. Request For Service, ring # = "zero"
Op code = "00". This combination of codes is used by the computer to handle interrupts by the nodes. If a node has an interrupt flag up (request for service), only a Request for Status will reset the addressed node interrupt flags.

CSIF



CRIF



I_f = Interrupt Flag. This is the interrupt flag put in by the first node that receives the "Request for Service" Code. This node then fills in its "ring #" in bits 3, 4, 5, 6, 7 and 8 of the text. If nodes later in the ring see that I_f is set to a one and has an interrupt flag then they may not put their ring # in the text.

T_i = Temporary Interrupt. The later nodes that cannot set the I_f flag will set this flag. By this means the computer knows it will have to service more interrupts on the ring.