Controller Network MELSECNET/G

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Article Introduction

Controller network MELSECNET/G is a network system for distributed control devices, and can transmit and receive large amounts of data in real time. MELSECNET/G features (1) high-speed and high-capacity cyclic transmission; (2) a highly reliable network with dual transmission lines; (3) troubleshooting support in the event of cable failure or faulty wiring; and (4) easy troubleshooting with visible network diagnostics.

1. Introduction

MELSECNET is a control network system that interconnects distributed controllers such as programmable controllers and personal computers. Using high-speed and high-capacity link devices, MELSECNET transmits and receives machine operation data between the distributed controllers in real time.

In the newer production lines for semiconductors, LCD devices, etc., machinery has become increasingly sophisticated and a growing volume of data is transmitted and received across the network for control, recipe and monitoring purposes. In addition, as the performance of machinery becomes more sophisticated, shorter communication response time is required. Such technical demands necessitate a network system that meets the users' needs such as a larger amount of communication data handled by the controller network and higher transmission rate.

In response, we have developed the controller network system MELSECNET/G as the next-generation MELSECNET, offering more link device points and a higher transmission rate. The combination of MELSECNET/G and controllers compatible with the integrated platform reduces tact time in the production line as well as raises communication performance.

2. Specifications of Communication

Table 1 shows the communication specifications of MELSECNET/G.

3. Features of MELSECNET/G

In addition to higher-speed and higher-capacity communication performance, controller network users also require that a system fault, e.g., station down and cable failure, does not lead to an overall system failure, and that prompt troubleshooting can be done in the event of such a fault. MELSECNET/G features the following functions that satisfy these requirements.

Table 1 Communication specifications

Item	Specification
Maximum link points per network	Link relay: 32 K bits Link register: 128 K words
Maximum link points per station	Link relay: 16 K bits Link register: 16 K words
Communication speed	1 Gbps
Connectable stations per network	120 stations
Connection cable	IEEE 802, 3Z (1000 BASE-SX) Optical fiber cable (multimode fiber cable)
Interstation distance	Up to 550 m
Maximum number of networks	239
Type of transmission line	Duplex loop
Transmission method	Token ring method
Synchronization system	Flag synchronization (Frame synchronization)
Encoding method	8B/10B
Packet format	Ethernet II
Error control method	HCS (CRC32 of header) DCS (CRC32 of data) FCS (Conforming to Ethernet)

3.1 Higher performance network system

Cyclic transmission serves as the base of MELSECNET, where data is periodically communicated between all stations on the network at a specific interval. Data communication using this function can be established only by setting the appropriate parameters, and thus system configuration is simple.

The cyclic transmission of MELSECNET/G allows the communication link points (number of data items) up to 32 K bits for the link relays (bit information) and 128 K words for the link registers (word information). Compared to MELSECNET/H, the number of link points is doubled for the link relays and eight times more for the link registers.

The data transmission rate crucially affects the users' main concern: improvement of tact time and production yield in their production line using a distributed control system. With the transmission rate of 1 Gbps by MELSECNET/G, assuming a system of 32 stations and each station transmits 2K-word link register data, the system delivers a 5 msec or shorter link scan time (the cycle time required for all stations to sequentially transmit data), some 14 times faster than that of MELSECNET/H.

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3.2 Highly reliable network system

MELSECNET/G provides a duplex transmission line through a loopback function using 2 core cables. As illustrated in Fig. 1, when the cable is connected only to the IN or OUT port, the loopback function performs both data reception and transmission from/to other stations at the port connected with the cable. This function isolates a faulty section due to cable breakage or a faulty station and continues to perform the cyclic transmission between normal stations.

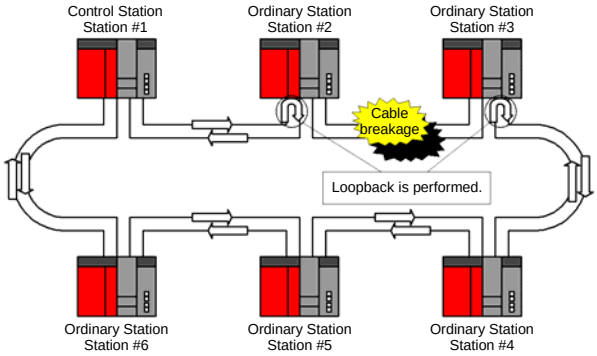

Fig. 1 Loopback function

3.3 Easy troubleshooting in the event of failure

3.3.1 Troubleshooting support in the event of cable failure

In the conventional network, if a faulty data frame caused by breakage of an optical fiber cable or failure of a communication connector, for example, is sent out to the network line, a transmission error is detected at all stations on the network (due to the increase in CRC errors and/or short frames), making it difficult to locate the failure and prolonging system recovery. In contrast, MELSECNET/G uses, in addition to the frame check sequence (FCS) conforming to Ethernet, a header check sequence (HCS) embedded in the frame header and a data check sequence (DCS) attached to the data, whereby the station that received the faulty frame can be identified. This function speeds up troubleshooting for cable failures and reduces maintenance time.

3.3.2 Troubleshooting support when installing cables

MELSECNET/G requires cable connections between the OUT port of other stations and its own IN port, and between its own OUT port and the IN port of other stations.

As shown in Fig. 2, when the cables are wired in the MELSECNET/G system, two stations at the end of the cables perform auto-negotiations for the connecting ports. If a faulty connection, either IN-IN or OUT-OUT, is detected, these stations do not join the network. This function avoids a delay in system setup caused by faulty wiring.

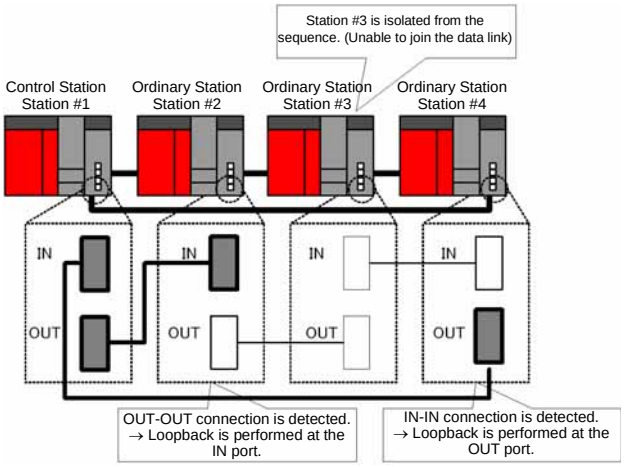

Fig. 2 Cable insertion error detection function

3.3.3 Convenient operability of network diagnostics

Conventional network diagnostics by GX Developer provides the operating conditions of all stations on the network as a bit sequence arranged in the order of station number. Therefore, in the event of a failure caused by cable breakage, etc., in order to determine the fault location it is necessary to determine the sequential order of all stations on the network using a system configuration diagram or the like. In contrast, MELSECNET/G collects the cable connection status for all stations when the network is being re-established and constructs the information on the sequential order of all stations on the network. As a result, as shown in Fig. 3, the network diagnostics of MELSECNET/G visibly indicates the sequential order and operating conditions of each station on the network. This function enables rapid troubleshooting of network failures and reduces maintenance time.

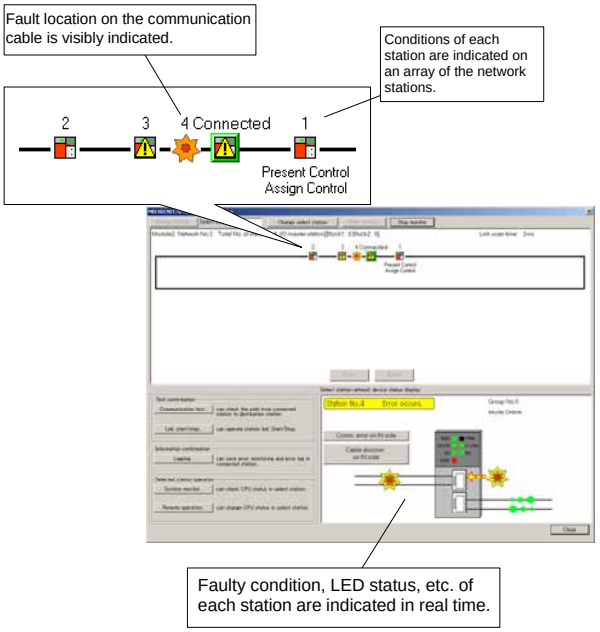

Fig. 3 MELSECNET/G network diagnosis

4. Summary

We have developed MELSECNET/G network products: MELSEC-Q compatible interface unit and personal computer interface board. We will continue to expand the lineup and functionality of MELSECNET/G network products.

References

(1) Masanori Kachi, Shigeru Yoshida: Network System of MELSEC-Q Series, Mitsubishi Electric Corporation Technical Reports, Vol. 74, No. 07 (2000)