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(54) **Circuit device for talks between smart transmitters and process control systems**

Schaltungsanordnung zur Übertragung zwischen intelligenten Messumformer und  
Prozesssteuerungssystemen

Circuit pour la communication entre transmetteurs intelligents de mesure et systèmes de commande  
de processus

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**'The digitisation of field instruments'**

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## Description

The present invention relates to a circuit device for talks between smart transmitters and process control systems, of the type comprising a wiring board for the transmitter cables and a multiplexing and interfacing unit for talking with process control units.

In the field of the industrial control, it is necessary that those who perform servicing and maintenance activities concerning work services for carrying out modifications, configurations, adjustments, conditionings and process diagnostics, should put the smart transmitters in a position to be always homogeneous with the intelligent terminals to which these information signals are sent. Said smart transmitters are those transmitters that, in addition to using two connecting wires for current supply and for transmitting a process variable by modulating the average value of the current in an analog gap of  $4 \div 20$  mA (corresponding to the gap  $0 \div 100\%$  of the full scale), also succeed in communicating signals, through a current and voltage modulation, in a bidirectional manner, by transferring information of a digital character (codes, numbers, commands).

In greater detail, although quality standards such as ISO-9000 require a written specification of the servicing and conditioning operations on the instruments, unfortunately often no homogeneity exists between the transmitters, that is the detection sensors, and the process control units of the D.C.S. (Distributed Control System) type, that is the terminal units that must receive these signals, due to the fact that the respective constructors adopt different communication standards. For the above reason, those who must use these apparatus and transmitters, if they do not buy them from the same supplier who is supposed to deliver homogeneous equipments, encounter the inconvenience of having a non-homogeneous installation, in which the field instrumentation section wherein signals must transmit detections to detecting units, does not communicate through digital signals with the control room.

Therefore it is necessary for the customer to buy the installation from the same supplier, otherwise the hardware structure will not have a homogeneous character, or will have it only by chance.

In addition, for carrying out detections in installations in which the hardware structure is not homogeneous, the only possibility is that one should position himself on the transmitter terminals with portable instruments. However it is obvious that since there are hundreds of signals from the respective transmitters, an equal number of detections should be carried out.

As a result of the foregoing, it has become necessary to interface at least the HART (Highway Addressable Remote Transducer) signals which are protocol signals from smart transmitters of the particular type connected to DCS stations, that is stations in which communication signals from said transmitters are sent, so that the installation parts may be compatible with

each other and therefore talk in an optimal manner.

It is an object of the present invention to overcome the limits of the known art, by providing a circuit device for talks between smart transmitters and process control units of the DCS type so that said talks may be intelligible and, as a result, the performance of the industrial control installation may be optimized.

In more detail, the present invention enables the digital signals of the smart transmitters to be wired and to be sent to a module capable of interpreting them and, in turn, sending them to a D.C.S. terminal unit, that is a computer provided with management software for the respective processing, in that presently there are no units that are homogeneous with the corresponding smart transmitters, obviously apart from those that are supplied by the same constructor, and wiring of the corresponding cables relating to smart transmitters is very hard.

The present invention therefore aims at overcoming the limits of the known art, by providing a circuit device for talks between smart transmitters and process control units of the DCS type as characterized in the first claim and subsequent subclaims.

A preferred embodiment of the invention is now described by way of non-limiting example with reference to the accompanying drawing in which the only figure is a block diagram of the device of the invention.

Referring to the drawing, a plurality of smart transmitters has been identified by 1, which smart transmitters send an equal number of signals denoted by 1a. 2 denotes a particular termination board to which the cables of said signals 1a are connected and wired so that the corresponding digital signals are picked up and multiplexed on said termination board towards connections denoted by 2a, from the same termination board.

Said connections 2a are then connected in circuit to a module 7 which has an equal number of corresponding connections 3a enabling a direct connection with an appropriate multiplexer 3 activating the precise addressing of said signals.

The multiplexer 3 also enables sending of said signals to a processing unit 8, of the PC type, by means of an appropriate modem 4.

Then modem 4 enables the digital signal to be demodulated so as to transmit it to a logic interfacing circuit 5 allowing the logical-digital decoding of said signals of the smart type for sending them to a communication circuit 6 that then talks to said processing unit 8. Limitedly to the present embodiment, the circuit 6 is of the serial type.

A particular software, called "Cornerstone", for management of said signals is then loaded in said processing unit 8 and it enables management of the smart signals, the configuration thereof, and a quality and state control.

Operation of the device of the invention described above mainly as regards structure, is as follows.

This device has the peculiarity that only digital sig-

nals 1a of smart transmitters 1 are wired on the termination board 2. In more detail, according to a wiring system being the object of patent application GB-A-2 250 386 of the same applicant, the cables from the smart transmitters are wired and the digital signals are coupled in circuit, through connections 2a, with those connections 3a of the multiplexer 3 that are present in the module 7. This multiplexer 3 is in turn mounted on an appropriate seat arranged in the terminal board 2 itself.

This circuit connection 2a-3a enables the digital signals from the smart transmitters to be directly sent to the DCS 8 through a serial port, of the RS485 type for example, which is a serial output of the multidropped type so that the DCS 8 can appropriately interpret said signals in a homogeneous manner through said management software named "Cornerstone", which is an open software package for integrated management of process signals.

When the digital signals are wired on the termination board 2 and sent to the module 7, the multiplexer 3 manages the addresses of said signals by discriminating them, and sends them through the appropriate modem 4 to the predetermined address; said signals interfaced by the circuit 5 are then sent to the DCS unit 8 that has asked for them and said unit 8 receives the exact signal (number seventeen, for example) of the smart terminal that was to be detected.

In this manner a discrimination work is carried out only on the digital part of the smart signal and in particular, limitedly to this embodiment, reference may be made to the HART protocol normally used in smart transmitters of the industrial sector.

Usually this module 7 is capable of managing 32 HART signals at most, relating to an output range of 4/20 A.

The reference baud rate of said module in this embodiment has a value of about 9,600.

The invention achieves the intended purposes. In fact, relating to the above embodiment, independently of the supplier for the DCS unit 8 and for the smart transmitters 1, by coupling of the termination board 2 and module 7, as well as of the managing software called "Cornerstone", it is possible to wire, multiplex, send and interpret the signals from the smart transmitters having a HART protocol in a homogeneous manner, by utilizing, at least in the case herein described, a standard RS485 serial port, which makes it possible to achieve an independence from the possible non-homogeneity of structure of the industrial control installation.

In addition, detection and interpretation of data in real time becomes universal, although there are no particular charges for wiring and no further room is required in the arranged racks of said industrial control modules, in that module 7 is part of the same termination board 2 on which the other modules, barrier modules and the like, relating to the intrinsic safety and industrial control are usually located.

Obviously many modifications and variations may

be made to the invention as conceived without departing from the scope of the appended claims.

## 5 Claims

1. A circuit device for talks between smart transmitters (1a) and process control systems (7) of the type comprising a plurality of transmitters (1) wired on a termination board (2) talking to a terminal unit (8), characterized in that said smart transmitters (1) are wired on a termination board (2) carrying circuitry that detects the digital communication signal (1a) from each transmitter (1), the signal wired on said termination board (2) being connected in circuit to a module (7) which multiplexes said signals (1a) and sends them, through interfacing means (5), to said terminal unit (8).
2. A circuit device according to claim 1, characterized in that said module (7) present on the termination board (2) internally comprises a multiplexer circuit for addressing of said signals in a circuit connection respectively with a modem (4) for sending of said signals (1a), and with a logical interface (5) for interpretation, through a serial port, of said signals that are sent to the terminal unit (8).
3. A device according to claim 1, characterized in that said circuit module (7) enables connection to a terminal unit (8) through a further communication circuit (6) connected to the previously cited circuit parts.
4. A device according to claim 1, characterized in that said terminal unit (8) has a software package loaded in its memory, for the integrated management of process signals, so as to enable the recognition of the digital signals (1a) from the smart transmitters independently of the hardware present in the installation.
5. A device according to claim 1, characterized in that said circuit module (7), present on the termination board (2), is directly wired on connectors present on the termination board (2) itself.
6. A device according to claim 1, characterized in that said serial port of the logical interface (5) is of the RS485 type.
7. A device according to claim 1, characterized in that said software package for the integrated management of process signals is of the type called "Cornerstone".

**Patentansprüche**

1. Schaltungsanordnung zur Übertragung zwischen intelligenten Meßumformern (1) und Prozeßsteuersystemen (7), umfassend eine Vielzahl von an einem Klemmenbrett (2) verkabelten Meßumformern (1) in Kommunikationsaustausch mit einer endseitigen Einheit (8), dadurch gekennzeichnet, daß die intelligenten Meßumformer (1) mit einem Klemmenbrett (2) verkabelt sind, das das Schaltungen trägt, die das digitale Kommunikationssignal (1a) von jedem Meßumformer (1) erfassen, wobei das an dem Klemmenbrett (2) verkabelte Signal mit einem Modul (7) verbunden ist, der die Signale (1a) multiplexiert und sie über Schnittstellenmittel der genannten endseitigen Einheit (8) zusenden. 5 10 15
2. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der genannte Modul (7) am Klemmenbrett in seinem Inneren eine Multiplexschaltung für die Adressierung der genannten Signale in schaltungsmaßiger Verbindung jeweils mit einem Modem (4) für die Abgabe der genannten Signale (1a) umfaßt, und mit einer logischen Schnittstelle (5) zur Auslegung über ein serienweises Gatter der genannten Signale, die der endseitigen Einheit (8) zugesandt werden. 20 25
3. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Schaltungsmodul (7) die Verbindung mit einer endseitigen Einheit (8) über eine weitere Kommunikationsschaltung (6) erlaubt, die mit den vorgenannten Schaltungsteilen verbunden ist. 30
4. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß die endseitige Einheit (8) ein im eigenen Speicher eingespeichertes Software-Paket zur integrierten Prozeßsignaleorganisation derart aufweist, daß die Erkennung der digitalen Signale (1a) von den intelligenten Meßumformern unabhängig von der in der Anlage anwesenden Hardware erlaubt wird. 35 40
5. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der am Klemmenbrett (2) anwesende Schaltungsmodul (7) direkt mit den am Klemmenbrett selbst anwesenden Verbindern verkabelt ist. 45
6. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß das serienweise Gatter der logischen Schnittstelle (5) nach der Art RS485 ist. 50
7. Schaltungsanordnung nach Anspruch 1, dadurch gekennzeichnet, daß das Software-Paket für die integrierte Organisation der Prozeßsignale nach der Art genannt "Cornerstone" ist. 55

**Revendications**

1. Circuit pour la communication entre transmetteurs intelligents (1) de mesure et systèmes de commande de processus, du type comprenant une pluralité de transmetteurs (1) câblés sur une plaquette de terminaison (termination board) (2) en communication avec une unité terminale (8), caractérisé en ce que lesdits transmetteurs intelligents (1) sont câblés sur une plaquette de terminaison (2) portant des circuits détectant le signal de communication digital (1a) en provenance de chaque transmetteur (1), le signal câblé sur ladite plaquette de terminaison (2) étant relié à un module (7) qui multiplexe lesdits signaux (1a) et les envoie, par l'intermédiaire de moyens d'interface, à ladite unité terminale (8).
2. Circuit selon la revendication 1, caractérisé en ce que ledit module (7) présent sur la plaquette de terminaison comporte à son intérieur un circuit de multiplexage pour l'adressage desdits signaux reliés en circuit respectivement à un modem (modulateur/démodulateur (4) pour l'envoi desdits signaux (1a), et à une interface logique (5) pour l'interprétation, à travers un port sériel, desdits signaux qui sont envoyés à l'unité terminale (8).
3. Circuit selon la revendication 1, caractérisé en ce que ledit module de circuit (7) permet la liaison à une unité terminale (8) à travers un autre circuit de communication (6) relié aux parties de circuits précédemment mentionnées.
4. Circuit selon la revendication 1, caractérisé en ce que ladite unité terminale (8) a un paquet-programme ou progiciel chargé dans sa mémoire, pour la gestion intégrée de signaux de processus, de manière à permettre la reconnaissance des signaux digitaux (1a) en provenance des transmetteurs intelligents, indépendamment du matériel présent sur l'installation.
5. Circuit selon la revendication 1, caractérisé en ce que ledit module de circuit (7) présent sur la plaquette de terminaison (2) est câblé directement sur des connecteurs présents sur la plaquette de terminaison elle-même.
6. Dispositif selon la revendication 1, caractérisé en ce que ledit port sériel de l'interface logique (5) est de type RS485.
7. Dispositif selon la revendication 1, caractérisé en ce que ledit progiciel pour la gestion intégrée de signaux de processus est du type appelé "Cornerstone".

