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(54) Abstract Title: **Searching identity space for devices connected to a bus using masks and increasing mask length when replies collide**

(57) A central controller discovering devices (eg. sensors, fire detectors) connected to a bus scans their identities (eg serial numbers) to elicit responses. If the identity space is large a brute force search (sending each identity in turn) can be impractical.

The invention issues requests with masked bits/characters which are set and unmasked ones set as null or 'don't care', and increments these set bits. Any device whose identity matches the masked bits will send a response and this information is recorded.

If multiple devices respond a collision results. In this event the mask length is extended and searching continues by varying the extension bits while keeping the original bits unchanged. Further collisions result in more extensions of the mask up to the full identity length, this can be done in several stages.

When an extension stage has been fully scanned the system reverts to incrementing the previous stage again, until the full identity space has been searched.

FIGURE 2

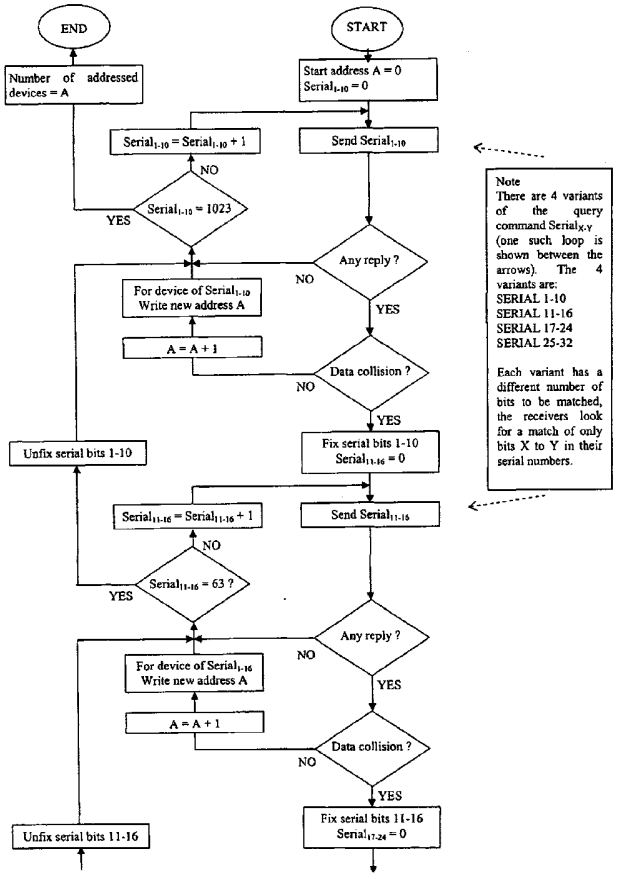

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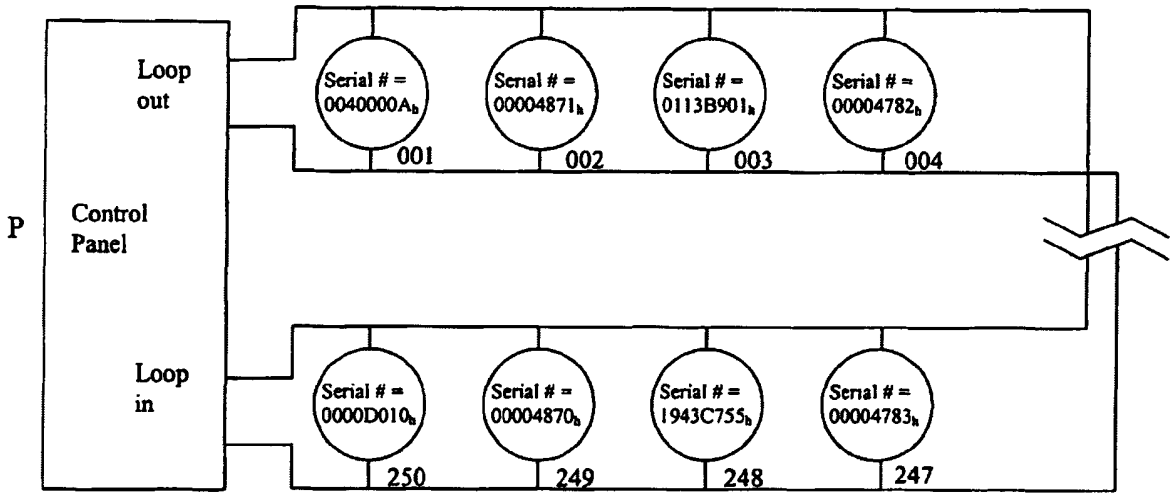
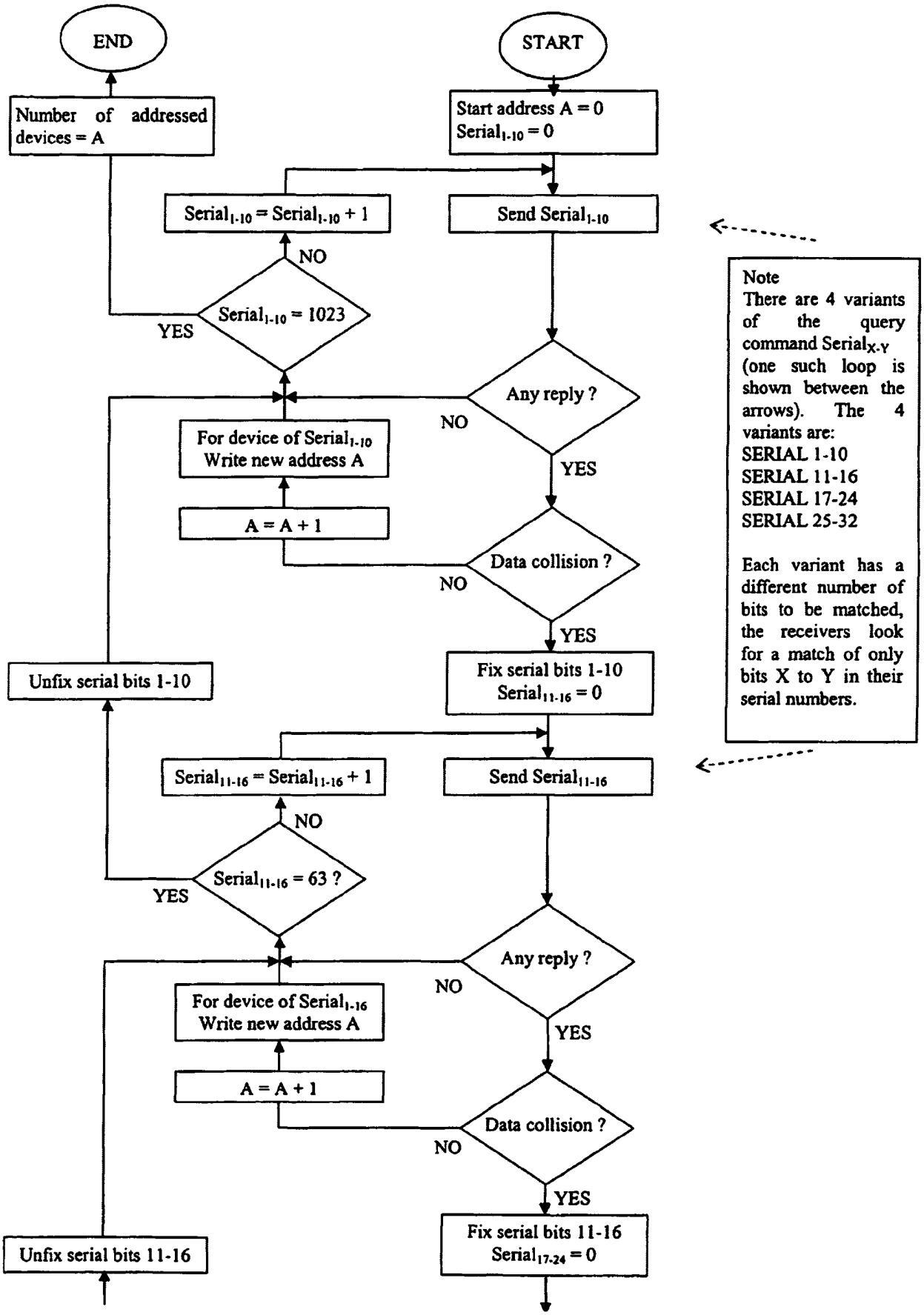
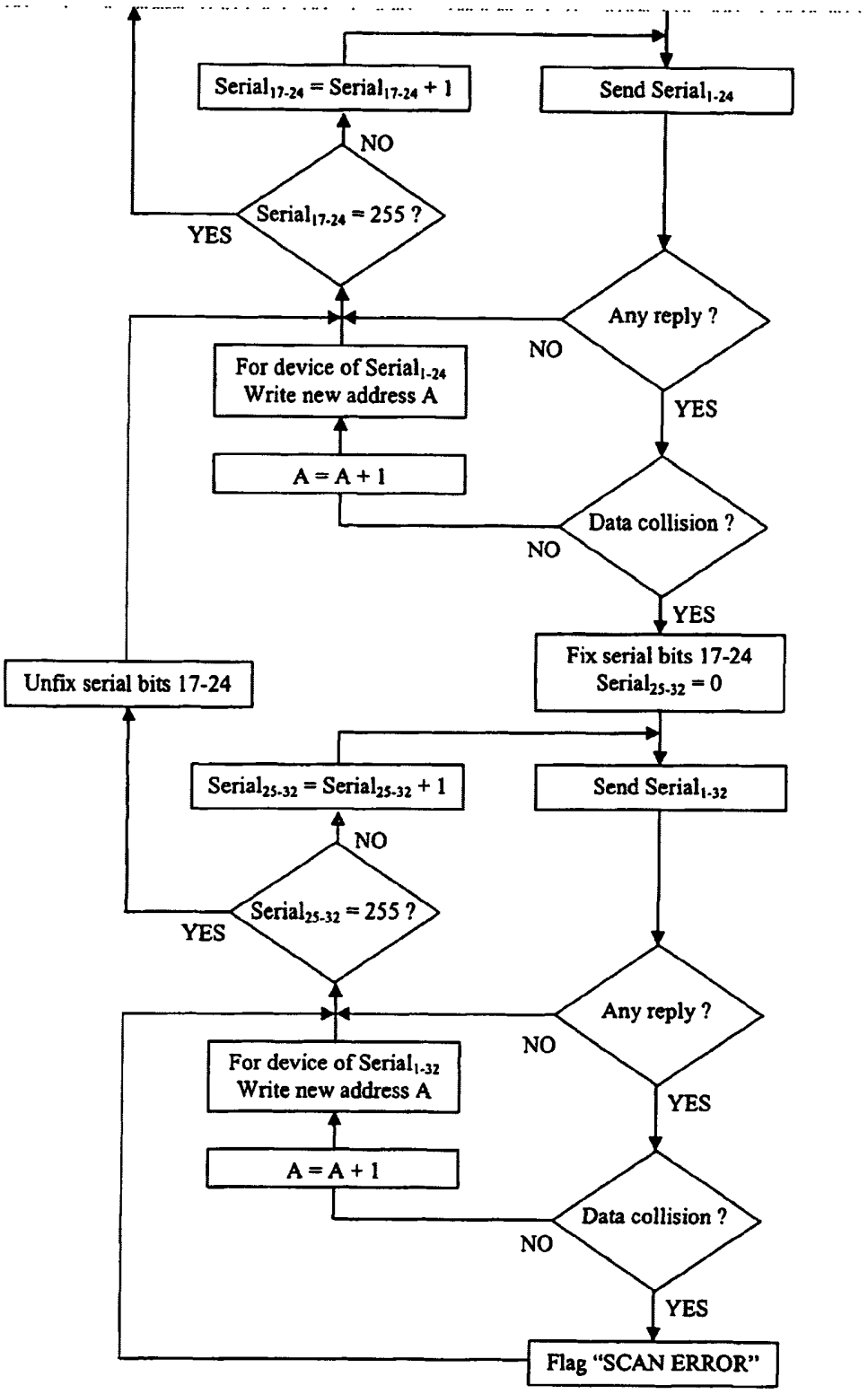
FIGURE 1



Block diagram of example auto addressing system

FIGURE 2


END
START
Number of addressed devices = A
Start address A = 0
Serial1-10 = 0
Serial1-10 = Serial1-10 + 1
Send Serial1-10
NO
Serial1-10 = 1023
YES
Any reply ?
NO
For device of Serial1-10 Write new address A
YES
A = A + 1
Data collision ?
NO
YES
Unfix serial bits 1-10
Fix serial bits 1-10
Serial11-16 = 0
Serial11-16 = Serial11-16 + 1
Send Serial11-16
NO
Serial11-16 = 63 ?
YES
Any reply ?
NO
For device of Serial1-16 Write new address A
YES
A = A + 1
Data collision ?
NO
YES
Unfix serial bits 11-16
Fix serial bits 11-16
Serial17-24 = 0
Note
There are 4 variants of the query command SerialX-Y (one such loop is shown between the arrows). The 4 variants are:
SERIAL 1-10
SERIAL 11-16
SERIAL 17-24
SERIAL 25-32
Each variant has a different number of bits to be matched, the receivers look for a match of only bits X to Y in their serial numbers.


Serial17-24 = Serial17-24 + 1
Send Serial1-24
NO
Serial17-24 = 255 ?
YES
Any reply ?
NO
For device of Serial1-24
Write new address A
YES
A = A + 1
Data collision ?
NO
YES
Fix serial bits 17-24
Serial25-32 = 0
Unfix serial bits 17-24
Serial25-32 = Serial25-32 + 1
Send Serial1-32
NO
Serial25-32 = 255 ?
YES
Any reply ?
NO
For device of Serial1-32
Write new address A
YES
A = A + 1
Data collision ?
NO
YES
Flag "SCAN ERROR"

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Identifying a Plurality of Devices

This invention relates to a method of identifying a plurality of devices bearing identification numbers.

The invention finds particular, though not exclusive, application in identifying individual ones of a plurality of electrical devices, such as sensors.

A room, building, factory or other industrial plant may be provided with a plurality of electrical devices such as sensors, which devices may be controlled from a central location. For example, a large number of fire detectors may be distributed throughout an oil refinery. Such devices may be similar to each other, may be programmed to an identical default state so that detectors of the same type will leave the factory with a common default configuration (apart from their serial numbers), and yet (some at least) may need to be configured differently from each other. During manufacture, the devices are usually programmed with a unique serial number, there may be a very large quantity of such devices, differing only from one another by their serial numbers, all of which are of the same format. Any one operator could be expected to have a selection of such devices, perhaps of random serial numbers, or the devices may be connected at random into a detection system or an initially-ordered system may be disturbed in time by replacements. At any one time, therefore, the operator may have a quantity of devices whose actual serial numbers he may not know. When such a collection of devices is linked together by a common communications link from a central control station, it thus becomes very difficult to determine which serial numbers are available and with, for example electronically interrogating, which devices they are associated.

It is known to identify serial numbers and to associate them with respective electrical devices by dealing with the devices individually, for example by electronically interrogating the devices separate from the central control station, or by attaching one device at a time.

It is also known to arrange for each device in turn to "break" the communications link and to "reattach" the connection to the next device when its serial number has been

identified. However, this method requires the devices to be provided with hardware specifically for this purpose, becoming redundant once the identification and subsequent configuration has been effected. This results not only in an undesirable additional expense for the device, but also complication of the design and installation of the communications link.

It is also known to "scan" all the devices for each possible serial number from the known totality, or range, of serial numbers. A "scan" is understood to be the operation whereby a set of queries (master messages) is sent out by a control panel, each commanding that only the device with the matching serial number must reply (slave message). However, due to mass production, there may be a very large number of possible serial numbers that need to be scanned until a match is found, so the scanning could require an unacceptable amount of time to complete. Even though it is possible to arrange for there to be a delay in the sending of a matched identification signal back to the control panel to avoid a plurality of such messages colliding and disrupting the scanning, the quantity of possible serial numbers, together with the required tolerance of the timer within each device, still makes this approach too time consuming, and thus impractical.

It is an aim of the present invention to provide a more practical method of identifying serial numbers of a plurality of devices.

In accordance with one aspect of the present invention, there is provided a method of identifying a plurality of (electrical) devices connected along a common (electrical) communications link, wherein each device bears a unique identification number belonging to a defined range of such numbers, wherein a control station scans the devices by sending a succession of interrogation signals along the communication link, the interrogation signals comprising a representation of the identification numbers of the devices, wherein a first scan is carried out with interrogation signals identifying only the least significant level of the range of identification numbers, wherein each device is programmed to generate, and to send to the control station, a response signal that comprises its complete identification number and a checksum, upon receipt of a scan signal applicable thereto, wherein, in the event that two or more of the devices generate a response signal as a result

of the first scan, the response signals will be deemed to be invalid by the control station, and the first scan is paused, wherein upon pausing of the first scan, the control station

initiates a second scan comprising interrogation signals identifying the least significant level of the range of identification numbers together with the next higher level thereof, wherein successive scans are carried out by the control station, adding the next higher level of the range of identification numbers, wherein upon completion of a scan that does not give rise to invalid responses, the previously-paused scan is resumed, wherein successive scans are carried out until, after all levels of the entire range of identification numbers have been scanned, only a single response is returned from any one complete scan, whereby the control station associates a unique identification number with each of the devices.

Thus, the scanning carried out in accordance with the present invention results in the serial numbers of the devices being identified in a significantly reduced time compared with that required for known identification techniques, since scanning of all possible numbers is not required. By way of example, it is pointed out that if a serial number were 32 bits deep (in binary form), there would be approximately 4 billion possible serial numbers in that range.

The interrogation signals (master messages) sent from the control station contain a serial number (or at least part thereof) and command that only the device with the matching serial number (or at least a defined matching part) must generate a response signal (a slave message). The slave message from a device may begin immediately upon receipt of the master message, or otherwise within a predetermined minimum time, in order to ensure that if two or more devices do generate a response signal as a result of any one scan, they are treated as invalid responses by the control station. Invalid responses may be considered as "collisions". Upon detection of a collision, scanning is then continued at the next higher scanning level, and so on, until all collisions have been resolved and the control station has made a one-to-one association between devices and serial numbers. It will be appreciated that to attain this required outcome, the control station does not need to know the quantity of devices that are connected in the communications link.

Thus, the increased efficiency achieved, that is to say the reduced time required, by the scanning technique of the present invention, is based on the occurrence of collisions between response signals from the devices being scanned.

In addition to containing the complete serial number, the slave message reply advantageously includes a checksum or parity configuration, to ensure that the control station receives unintelligible data or an erroneous checksum when more than one device replies. Use of the checksum ensures that the control station can differentiate between, on the one hand, a non-response or a glitch/EMC event and, on the other hand, a valid uncorrupted response from a single device or a collision. A valid uncorrupted response from a single device results in scanning being continued at the next highest level without reversion to the previous scan level, whereas after a collision has been resolved, scanning reverts to the lower level at which it was paused.

In one embodiment of the present invention, a maximum of 250 devices are connected to a 2-wire communications loop, each device bearing a serial number 32 bits deep (in binary form). The first scan is carried out in respect of the lowest portion (least significant bits) of the serial number, since that is the most diverse, or random, in any given selection of devices. Thus, optimally only the lowest 10 bits are scanned initally, with bits 11-32 being ignored. This optimal scanning process ensures the minimal overall time to identify all the devices. Thus, using 10 bits for the first level scan will statistically yield the minimum overall scan time (assuming a preferred arrangement having between 20 and 250 devices to be identified). If 8 bits are used instead of 10 bits, the risk of collisions increases as does the requirement for many second level scans. If 12 bits are used instead of 10 bits, this will result in a very much longer first scan. In either case, therefore, the statistically average overall scan time will be longer than when using 10 bits. Statistically, approximately 64 collisions, representing around a 25% chance of a collision per master message, for a random set of bit values, may be expected. Should a data collision occur during a scan, the master message is modified by the addition of more bits of the serial number, whilst retaining the bits used in the message when the collision occurred. Thus, in this embodiment, the modified message will retain the last 10 bits of the serial number as a constant value, and bits 11 to 16 will be varied during the new, higher level scan. Thus, 64 master messages using a 16 bit address will form the new level

scan. When that scan is complete, and in the event of no other collisions, the original 10 bit scan is resumed. On the other hand, should a data collision occur during the 16 bit scan, then that scan is paused and another scan is performed at a yet higher level using, in this embodiment, 24 bits of the serial number range, with the last 16 bits remaining the same. Thus, at this third scanning level, 256 master messages using a 24 bit serial number will form the scan. Statistically, the chance of a collision during this scan is vanishingly small, but should a collision occur then a further scan using all 32 bits of the serial number, with the last 24 bits remaining the same will form the new scan of 256 master messages using the full 32 bit serial number. In this way, with a maximum 250 devices involved, up to four levels of scan may be required.

It is possible when carrying out the method of the present invention that a large number of units may simultaneously attempt to reply to a master message. To avoid an overload and shutdown of the communications link, an algorithm is provided at the control station that, in this event, assumes that a data collision has occurred, whereby the communications link is maintained and the scanning directed to the next higher level as set out above.

The identification, or serial, numbers of the devices may be in the form of hexadecimal numbers, binary numbers or alpha numeric characters.

Subsequent to the identification of each of the devices by its unique identification number, the control station is arranged to accord a simplified unique address number to each device for use in subsequent communication therewith. It will be appreciated that such address number may have fewer characters than the manufacturer's assigned identification number, and may be in accordance with a required address system of the operator of the control station.

The driver of the data around the communication link, at the control station, will also be arranged to note that a scan error has occurred if the total number of devices identified exceeds the known actual number of devices that are connected thereto.

Having identified the plurality devices in accordance with the method of the present invention, the control panel is then in a position to communicate therewith in order to configure the devices in any required manner. In one embodiment of the invention, the devices comprise sensors, such as fire sensors, smoke sensors and temperature sensors, and the configuration may be in respect of the particular sensing function to be carried out by each sensor device. For each detector, once identified and addressed, its type can be identified remotely by the control station, thereby enabling configuration as appropriate. For example, the sensitivity of a device may be set by the control station, and this may differ from one device to another. The configuration may also involve ensuring that the sensor sends an alarm signal to the control station whenever the value of a parameter that is sensed has fallen to, or has exceeded a predetermined value. In the case where a sensing device comprises more than one sensor, possibly of different types, the configuration can arrange for each of them to respond accordingly, in a different manner from the other sensors of the same device.

In accordance with another aspect of the present invention, there is provided a sensing system comprising a control station and a plurality of sensors connected together along a communications link, wherein each sensor bears a unique identification number belonging to a defined range of such numbers, wherein the control station is arranged to carry out a succession of scans of the sensors throughout the entire range of the identification numbers, thereby to identify the identification number of each sensor, the first scan being in respect of the least significant level of the identification numbers and successive scans adding respective higher levels thereof, wherein upon a match between the scanning number and its identification number in any one scan, each sensor is arranged to send to the control station a response signal comprising its full identification number and a checksum, wherein upon receipt of two or more response signals arising from any one scan, the control station is arranged to pause that scan and to proceed to the next highest level scan until only one response is received from a higher scan, whereupon the preceding scan is resumed, wherein subsequent to the association of unique identification numbers with the respective sensors, the control station is arranged to accord a simplified address number to each sensor for subsequent communication therewith, wherein the control station then sends a signal to the sensors individually to effect their configuration with respect to the particular parameter being sensed.

It will be appreciated, that the sensing system of the present invention may be operated in accordance with the method thereof.

The present invention thus requires little or no extra hardware to be provided in the devices or in control and indicating equipment.

The devices to be identified can be placed in any order on the communications link, and the method is operable also when devices are located on spurs of the main link. The serial numbers of the devices may thus be in any order along the communications link.

It is also envisaged that extra data could be added to the slave messages to ensure the integrity of non-colliding messages, whilst maximising the corruption of collided messages. This may be by way of parity checking or checksum verification.

Furthermore, in accordance with the present invention, extra information can be added to the messages that could aid quick identification or configuration of a particular type of device without having to resend another message from the control station, thus enabling swift commissioning of the set of devices. For example, different devices could be configured for different sensing functions.

The number of scan combinations for each scanning step can be optimised to minimise the total scan time for a given number of devices. Thus, the more devices to be configured will lead to a larger initial scan range to achieve optimal identification time. Fewer devices will require a smaller initial scan.

It will also be appreciated that the present invention is suitable not only for identifying a totally fresh set of devices in a system, but can be used to identify additional or replacement devices in an already-operational system. In such an arrangement, those devices that have already been identified by the control station and have been given the unique address code (if applicable) may be arranged to send a response signal upon being scanned that includes the address code for that device, so that that response signal could be ignored by the control station during the scanning procedure.

It is preferred that all interrogation signals (master messages) have a form of parity or checksum confirmation to ensure the integrity of the data sent. However, this could lead to the undesirable effect of glitches on the communication loop inhibiting the response from a device when a scan is in progress, therefore resulting in that device not being identified. A glitch in the loop could result in a misinterpretation of one or more of the transmitted bits. Use of error checking methods will result in the checksum not matching that of the transmitted bits, so the message contents are discarded. In the case of a glitch in the master message, the devices which it is trying to communicate with will, instead, discard the message. As a result it does not respond or is not identified. To overcome this problem, when a scan has been completed, unidentified devices may be found by arranging for the control station to send out a global interrogation signal commanding that all unidentified devices respond. Should a large number of devices respond to such a global interrogation signal, it is envisaged that the scanning of the method of the present invention would have to be restarted from its base level, with an interrogation signal from the control station commanding that previously-identified devices should not sent response signals.

It is envisaged that the present invention may be encapsulated in a microprocessor for carrying out the scanning operations, and to be used particularly, though not exclusively, with fire sensors or other related devices, in combination with control and indicating equipment in the form of an analogue addressable fire panel.

A method and system for identifying a plurality of devices, each in accordance with the present invention, will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of the sensing system; and
Figure 2 is a flow chart of the identifying method.

Referring to Figure 1, a control panel P is shown supplying a two wire communications loop, with 250 sensors, numbered 001, 002... 249, 250, connected in parallel between the wires. As shown, each of the sensing devices 001 to 250 is provided with a unique serial number.

The identification of those serial numbers of the devices 001 to 250 by the control panel P is carried out by scanning in accordance with Figure 2, which will now be described.

To start, an address counter value "A" and the serial number value are set to 0000_{DEC} [**Start address A = 0, Serial$_{1\text{-}10}$ = 0**]. The serial number is broadcast to all devices [**Send Serial$_{1\text{-}10}$**]. Any devices with their 32 bit serial number ending with 0000 will reply with their full serial number and checksum value. Assuming no devices have their serial number ending with 0000, there will be no reply [**Any reply ? = NO**]. The broadcast serial number 0000 is not the last in the sequence to be tested [**Serial$_{1\text{-}10}$ = 1023 = NO**] hence the next serial number [**Serial$_{1\text{-}10}$ = Serial$_{1\text{-}10}$ + 1**] 0001 will be broadcast to all devices [**Send Serial$_{1\text{-}10}$**]. Any devices with their 32 bit serial number ending with 0001 will reply with their full serial number and checksum value. Assuming just 1 device has a serial number ending with 0001, there will be a reply [**Any reply ? = YES**] but no data corruption as indicated by the checksum data [**Data collision ? = NO**]. That device is next allocated the unique 'address' [**A = A + 1**][**For device of Serial$_{1\text{-}10}$ Write new address A**] by the control panel. The broadcast serial number 0001 is not the last to be tested [**Serial$_{1\text{-}10}$ = 1023 = NO**] hence the next serial number [**Serial$_{1\text{-}10}$ = Serial$_{1\text{-}10}$ + 1**] 0002 will be broadcast to all devices [**Send Serial$_{1\text{-}10}$**]. Any devices with their 32 bit serial number ending with 0002 will reply with their full serial number and checksum security value. Assuming two or more devices reply, the checksum received by the control panel will not correspond to the received message, and hence will be deemed to be invalid [**Data collision ? = YES**]. This being the case, this scan will be paused and the last 10 bits of the previously broadcast serial number will be fixed and a new scan will be initiated using bits 11-16 [**Fix serial bits 1-10, Serial$_{11\text{-}16}$ = 0**] as described here. Once that scan is complete the previous scan will be resumed continuing on with bits 1-10 and ignoring bits 11-16 [**Unfix serial bits 1-10**] using the next value [**Serial$_{1\text{-}10}$ = 1023 = NO**][**Serial$_{1\text{-}10}$ = Serial$_{1\text{-}10}$ + 1**] 0003. This will repeat until all combinations of the last 10 bits have been scanned [**Serial$_{1\text{-}10}$ = 1023 = YES**] such that all devices will have been identified and configured with a unique address [**Number of addressed devices = A**].

By way of example, the range of the serial numbers of the sensor devices 001 to 250 is taken to be:

00 00 00 00 to FF FF FF FF $_{LSB}$ (hex)

For reasons of simplicity of showing the preferred embodiment, the third byte of all the serial numbers is shown in binary form, e.g.:

00 00 (0000 0000) 00 to FF FF (1111 1111) FF $_{LSB}$

Assume that the system comprises only A to I devices, for simplicity in describing the scanning and its results, and that the devices have serial numbers, which are individually unknown to the control system, as follows:

Device A: 40 0B (0100 0000) 02
Device B: 0F 90 (0000 0000) 03
Device C: 17 33 (0100 0000) 06
Device D: 01 00 (0000 1000) 03
Device E: 22 60 (0000 1000) 03
Device F: 22 60 (0100 1000) 22
Device G: 01 45 (0110 1001) 66
Device H: 05 45 (0110 1001) 67
Device I: 02 45 (0110 1001) 66

The master messages sent out by the control panel P are as follows, where "x" denotes an insignificant character that may have any value, and which is disregarded:

Scan level	Scan serial	Comment
1 - Serial$_{1\text{-}10}$	xx xx (xxxx xx00) 00	Start of scan
1 - Serial$_{1\text{-}10}$	xx xx (xxxx xx00) 01	
1 - Serial$_{1\text{-}10}$	xx xx (xxxx xx00) 02	Found device A
1 - Serial$_{1\text{-}10}$	xx xx (xxxx xx00) 03	Devices B, D and E reply – data corruption
2 - Serial$_{1\text{-}16}$	xx xx (0000 0000) 03	2ND level scan initiated. Found device B
2 - Serial$_{1\text{-}16}$	xx xx (0000 0100) 03	

2 - Serial$_{1-16}$	xx xx (0000 1000) 03	Devices D and E reply – data corruption
3 - Serial$_{1-24}$	xx 00 (0000 1000) 03	3RD level scan initiated. Found device D
3 - Serial$_{1-24}$	xx 01 (0000 1000) 03	
3 - Serial$_{1-24}$	Scan though next 93 combinations	
3 - Serial$_{1-24}$	xx 5F (0000 1000) 03	
3 - Serial$_{1-24}$	xx 60 (0000 1000) 03	Found device E
3 - Serial$_{1-24}$	xx 61 (0000 1000) 03	
3 - Serial$_{1-24}$	Scan though next 157 combinations	
3 - Serial$_{1-24}$	xx FF (0000 1000) 03	End of 3RD level scan stage
2 - Serial$_{1-16}$	xx xx (0000 1100) 03	Resume 2ND level scan
2 - Serial$_{1-16}$	xx xx (0001 0000) 03	
2 - Serial$_{1-16}$	Scan though next 58 combinations	
2 - Serial$_{1-16}$	xx xx (1111 1100) 03	End of 2ND level scan stage
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 04	Resume 1ST level scan
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 05	
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 06	Found device C
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 07	
1 - Serial$_{1-10}$	Scan though next 25 combinations	
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 21	
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 22	Found device F
1 - Serial$_{1-10}$	xx xx (xxxx xx00) 23	
1 - Serial$_{1-10}$	Scan though next 321 combinations	
1 - Serial$_{1-10}$	xx xx (xxxx xx01) 65	
1 - Serial$_{1-10}$	xx xx (xxxx xx01) 66	Devices G and I reply – data corruption
2 - Serial$_{1-16}$	xx xx (0000 0001) 66	2ND level scan initiated
2 - Serial$_{1-16}$	xx xx (0000 0101) 66	
2 - Serial$_{1-16}$	Scan though next 23 combinations	
2 - Serial$_{1-16}$	xx xx (0110 0101) 66	
2 - Serial$_{1-16}$	xx xx (0110 1001) 66	Devices G and I reply – data corruption
3 - Serial$_{1-24}$	xx 00 (0110 1001) 66	3RD level scan initiated
3 - Serial$_{1-24}$	xx 01 (0110 1001) 66	
3 - Serial$_{1-24}$	Scan though next 66 combinations	

3 - $Serial_{1-24}$	xx 44 (0110 1001) 66	
3 - $Serial_{1-24}$	xx 45 (0110 1001) 66	Devices G and I reply – data corruption
4 - $Serial_{1-32}$	00 45 (0110 1001) 66	4^{TH} level scan initiated
4 - $Serial_{1-32}$	01 45 (0110 1001) 66	Found device G
4 - $Serial_{1-32}$	02 45 (0110 1001) 66	Found device I
4 - $Serial_{1-32}$	03 45 (0110 1001) 66	
4 - $Serial_{1-32}$	Scan though next 251 combinations	
4 - $Serial_{1-32}$	FF 45 (0110 1001) 66	End of 4^{th} level scan stage
3 - $Serial_{1-24}$	xx 46 (0110 1001) 66	Resume 3^{RD} level scan
3 - $Serial_{1-24}$	Scan though next 184 combinations	
3 - $Serial_{1-24}$	xx FF (0110 1001) 66	End of 3^{RD} level scan stage
2 - $Serial_{1-16}$	xx xx (0110 1101) 66	Resume 2^{ND} level scan
2 - $Serial_{1-16}$	Scan though next 35 combinations	
2 - $Serial_{1-16}$	xx xx (1111 1101) 66	End of 2^{ND} level scan stage
1 - $Serial_{1-10}$	xx xx (xxxx xx01) 67	Resume 1^{ST} level scan. Found device H
1 - $Serial_{1-10}$	xx xx (xxxx xx01) 68	
1 - $Serial_{1-10}$	Scan though next 662 combinations	
1 - $Serial_{1-10}$	xx xx (xxxx xx11) FF	End of scan

It will be appreciated, that with more than nine devices, the scanning will be more complex, but the principle is the same. Namely, a first level scan is carried out with the least significant digits of the serial numbers of the known range, and is stopped should a data collision occur. Scanning then resumes at a higher level, proceeding to the next higher level should a data collision occur again, until eventually no collision is detected in each level, the serial number of the corresponding device noted, and all of the devices have been identified in this way.

It will thus be appreciated that instead of using a method of identifying the devices whilst trying to avoid data collisions, which would be very time consuming, and involving scanning of all possible combination of serial numbers, the present invention specifically relies on the identification of erroneous data as a means of determining the next course of

action, namely modifying the number of bits used during a scan to increase the scan resolution as appropriate.

Claims

1. A method of identifying a plurality of devices connected along a common communications link, wherein each device bears a unique identification number belonging to a defined range of such numbers,

wherein a control station scans the devices by sending a succession of interrogation signals along the communication link, the interrogation signals comprising a representation of the identification numbers of the devices,

wherein a first scan is carried out with interrogation signals identifying a first level of the range of identification numbers,

wherein each device is programmed to generate, and to send to the control station, a response signal that comprises its complete identification number and a checksum, upon receipt of a scan signal applicable thereto,

wherein, in the event that two or more of the devices generate a response signal as a result of the first scan, the response signals will be deemed to be invalid by the control station, and the first scan is paused,

wherein upon pausing of the first scan, the control station initiates a second scan comprising interrogation signals identifying the first level of the range of identification numbers together with a higher level thereof,

wherein successive scans are carried out by the control station, adding the next higher level of the range of identification numbers, wherein upon completion of a scan that does not give rise to invalid responses, the previously-paused scan is resumed,

wherein successive scans are carried out until, after all levels of the entire range of identification numbers have been scanned, only a single response is returned from any one complete scan, whereby the control station associates a unique identification number with each of the devices.

2. A method according to claim 1, wherein the first scan is carried out in respect of the least significant level of the range of identification numbers.

3. A method according to claim 1 or claim 2, wherein a second or successive scan is carried out in respect of the next higher level of the range of identification numbers.

4. A method according to any one of claims 1 to 3, wherein the identification numbers are hexadecimal numbers.

5. A method according to any one of claims 1 to 4, wherein the identification numbers are binary numbers.

6. A method according to any one of claims 1 to 3, wherein the identification numbers are of alphanumeric form.

7. A method according to any one of claims 1 to 6, wherein, subsequent to identification of each of the devices by its unique identification number, the control station accords a simplified unique address number to each device for use in subsequent communication therewith.

8. A method according to any one of claims 1 to 7, wherein, subsequent to identification of each of the devices by its unique identification number, the control panel communicates with at least one of the devices to configure it in a particular manner.

9. A method according to claim 8, wherein the devices comprise sensors and the configuration is carried out in respect of the sensing function of each sensor device.

10. A method according to claim 9, wherein the configuration is in respect of the sensitivity of the parameter to be sensed by the device.

11. A method according to claim 9 or claim 10, wherein the sensors comprise fire sensors, smoke detectors, and/or temperature sensors.

12. A sensing system comprising a control station and a plurality of sensors connected together along a communications link, wherein each sensor bears a unique identification number belonging to a defined range of such numbers,

wherein the control station is arranged to carry out a succession of scans of the sensors throughout the entire range of the identification numbers, thereby to identify the identification number of each sensor, a first scan being in respect of a first level of the range of identification numbers and successive scans adding respective higher levels thereof,

wherein, upon a match between the scanning number and its identification number in any one scan, each sensor is arranged to send to the control station a response signal comprising its full identification number and a checksum,

wherein, upon receipt of two or more response signals arising from any one scan, the control station is arranged to pause that scan and to proceed to the next highest level scan until only one response is received from a higher scan, whereupon the preceding scan is resumed,

wherein, subsequent to the association of unique identification numbers with the respective sensors, the control station is arranged to accord a simplified address number to each sensor for subsequent communication therewith, and

wherein the control station then sends a signal to the sensors individually to effect their configuration with respect to the particular parameter being sensed.

13. A system as claimed in claim 12, wherein the control station is such that the first scan is carried out in respect of the least significant level of the range of identification numbers.

14. A system as claimed in claim 12 or claim 13, wherein a second or successive scan is carried out in respect of the next higher level of the range of identification numbers.

15. A system according to any one of claims 12 to 14, wherein the control station is arranged to configure the sensitivity of at least one of the sensors.

16. A system according to any one of claims 12 to 15, wherein the control system is arranged to configure at least one of the sensors to respond to a predetermined value, or range of values, of the parameter to be sensed.

17. A system according to any one of claims 12 to 16, wherein the control system is arranged to configure at least one of the sensors to respond whenever that sensor senses that the value of the parameter to be sensed has fallen to or has exceeded a predetermined value.

18. A method of identifying a plurality of devices connected along a common communications link, the method being substantially as hereinbefore described with reference to the drawings.

19. A sensing system substantially as hereinbefore described with reference to, and as illustrated by, the drawings.

Intellectual Property Office

For Creativity and Innovation

Application No: GB0713770.6 **Examiner:** Owen Wheeler

Claims searched: 1-19 **Date of search:** 18 October 2007

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,12 at least	US 2006/277309 A1 [EATON] See paragraphs 11-31.
X	1,12 at least	DE 10329420 A1 [SENSOPART] See abstract.

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^{X} :

Worldwide search of patent documents classified in the following areas of the IPC

H04L

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
H04L	0012/24	01/01/2006
H04L	0012/403	01/01/2006
H04L	0012/423	01/01/2006