

DESCRIPTION

METHOD AND APPARATUS FOR TRANSCIVING, RECEIVING AS WEEL AS TRANSMITTING

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to apparatus for and method of transmitting and receiving signals, apparatus for and method of receiving signals, and apparatus for and
10 method of transmitting signals, and more particularly to a transmitting and receiving method, a receiver and a receiving method, as well as a transmitter and transmitting method suited to an infrared transceiver system that transmits and receives data by means of infrared rays.

15 Background of the Invention

There are conventional bi-directional communication technologies used for the bi-directional communication of data between two communicators. The amount of data exchanged in such bi-directional communication has become very large, so higher speeds for this communication are desirable. Even in such cases, it is preferable that the
20 processes of transmitting and receiving data be performed with power consumption kept as low as possible.

One type of the system for the bi-directional communication of data is an infrared transceiver system that transmits and receives data by means of infrared rays. An infrared transceiver that permits such an infrared transceiver system, as shown in Fig.
25 1, comprises a microcomputer 102 constituting a control means, an infrared transceiver module 103 that is controlled by the microcomputer 102, and an LED (Light Emitting

Diode) 104 and PD (Photo Diode) 105 which serve as a light emitter and a light receiver, respectively.

In addition, the aforementioned microcomputer 102 further comprises a CPU core 111 that controls the various blocks, a UART (Universal Asynchronous Receiver/Transmitter) 112 that constitutes the data transmitter/receiver for transmitting and receiving data to and from the infrared transceiver module 103, and a PIO (Parallel I/O) 113 for transmitting control commands to the infrared transceiver module 103, all of which are connected to a data bus 114.

In addition, the infrared transceiver module 103 further comprises an amplifier 121 which is a driver for the aforementioned LED 104, and a receiver circuit (Receiver) 122 which constitutes a receiver for receiving signals from the aforementioned PD 105.

Here, as shown in Fig. 2, the receiver circuit 122 further comprises an I/V amplifier 123 for amplifying optical signals received from the PD 105, a filter (Filter) 124 that performs the filtering of output signals from this I/V amplifier 123, a detector (Detector) 125 that detects output signals from this filter 124, and a comparator 126 that compares the output signals from this detector 125 with a predetermined reference value (the "comparator level") and provides output of a shaped pulse.

In the receiver circuit 122 constituted as such, the signal waveform in each block based on the signal received by the PD 105 may become as shown in Fig. 3A through Fig. 3C. Here, the signal waveform shown in Fig. 3A is the signal output from the I/V amplifier 123 (signal a shown in Fig. 2), a signal waveform shown in Fig. 3B being that of the signal output from the detector 125 (signal b shown in Fig. 2) and the signal waveform shown in Fig. 3C being that of the signal output from the comparator 126 (signal c shown in Fig. 2).

Under the control of the microcomputer 102, the infrared transceiver 101 performs the generation of protocol, formatting and parallel/serial conversion upon the

transmission of data, and performs the serial/parallel conversion and data analysis upon the receiving of data.

Moreover, the infrared transceiver module 103 performs the driving of the LED 104 during transmission and, upon reception, amplifies signals from the PD 105 and shapes their pulses. It should be noted that in the microcomputer 102, the PIO 113 uses the RX/TX control commands to switch the infrared transceiver module 103 between the transmission and reception modes, and also uses the standby (STB) command to set it in its communication "OFF" mode.

In passing, since the microcomputer 102 is manufactured using the CMOS process, the current consumption is reduced through the miniaturization of devices and lowering of voltage. However, since it is general that the infrared transceiver module 103 is a analog circuit, a constant current is required during the driving of the LED 104 and during the reception by the PD 105, so it is difficult to lower the current consumption.

On the other hand, the following problem also occurs. Here, regarding the signal waveform in various blocks of the receiver circuit 122, we shall explain the case in which, as shown in the aforementioned Fig. 3A, the PD 105 receives a large (or wide) pulse width (low frequency) or small (or narrow) pulse width (high frequency) infrared pulse, for example.

For example, for a large pulse width (low frequency) signal, while the edge is delayed (blunted) in the response of the detector 125, the pulse width is large or wide so the pulse continues until the response of the detector 125 become stabilized, and namely the trailing edge of the pulse does not appear. Therefore, as shown in Fig. 3B, the detected signal b rises to the comparator level L. Thus, in the comparator 126, as shown in Fig. 3C, a stable shaped pulsed signal c corresponding to the received signal can be stably obtained.

However, for a small pulse width (high frequency) signal, the next pulse edge appears before the response is stabilized in the detector 125, so that, even though, as shown in Fig. 3B, the detected signal *b* rises, its level does not reach the comparator level *L*. Thus, the comparator 126 cannot shape a pulse.

5 It is possible to increase the responsiveness of the receiver circuit 122 to obtain formed pulses from pulsed infrared rays with a small pulse-width. For example, it can be considered that for increasing the responsiveness of the receiver circuit 122, it may be effective to increase the bias current of the I/V amplifier 123 and comparator 126, etc. or to reduce the time constants of the filter 124 and detector 125. However, if such
10 improved methods are adopted, this will result in the problem of increased operating current. The increasing of the communication speed of the infrared transceiver module 103 involves a trade-off with reducing the current consumption.

In addition, on the receiver circuit 122 side in particular, the receive standby state is normally necessary, so suppressing the power consumption of the entire device
15 in question tends to inhibit increasing the communication speed.

SUMMARY OF THE INVENTION

In view of such aspects, it is an object of the present invention to eliminate the above disadvantages and to provide transceiving apparatus and method, receiving
20 apparatus and method, transmitting apparatus and method that permit high-rate communication and also permit data to be received while reducing current consumption.

The transceiver according to the present invention comprises a transmission means that, at the start of transmission, transmits a signal of a second signal form that has a pulse rate lower than a signal of a first signal form and which is transmitted prior
25 to said signal of a first signal form; and a reception means which upon reception of said signal of a second signal form, receives said signal of a first signal form by switching a

mode from a first reception mode to a second reception mode which is a reception mode with a higher reception rate than the first reception mode.

In addition, the transceiver according to the present invention transmits, at the end of transmission of said signal of a first signal form, said signal of a first signal form including an end signal that indicates the end of said signal of a first signal form, and
5 upon receipt of said end signal, said reception means switches to said first reception mode.

Further, in the transceiver of the present invention, the current consumption of said reception means in said first reception mode is set smaller than the current
10 consumption of said reception means in said second reception mode.

The transceiver according to the present invention further comprises a transmission means that selectively transmits, as a pair, a plurality of information signals having different pulse rates and a plurality of guide signals which respectively correspond to said plurality of information signals and which are transmitted prior to the
15 transmission of same, and a reception means that, in response to receipt of each of said guide signals, switches its mode from reception standby mode to a reception mode corresponding to the pulse rate of the information signal paired with said guide signal to receive said information signal.

In order to solve the aforementioned problems, the transceiving method
20 according to the present invention comprises a transmission step wherein, at the start of transmission, a signal of a second signal form that has a pulse rate lower than a signal of a first signal form is transmitted prior to said signal of a first signal form, and a reception step wherein, upon the reception of a signal of a second signal form, the mode is switched from a first reception mode to a second reception mode with a reception rate
25 higher than this first reception mode and said signal of a first signal form is received.

In the transceiving method, a signal of a second signal form is transmitted prior to said signal of a first signal form in the transmission step, and said signal of a second

signal form is received in the reception step, so that a switching from the first reception mode to the second reception mode in order to receive a signal of a first signal form is performed for reception of a signal of a first signal form.

5 The transceiving method permits the reception means that receives signals to set its mode to a second reception mode with a high reception rate only when receiving a signal of the first signal form.

In addition, in order to solve the aforementioned problems, a receiver according to the present invention comprises a reception means that receives signals with switching between a first reception mode and a second reception mode having a higher
10 reception rate than this first reception mode; and a control means that, upon reception of a signal of a second signal form, controls the switching of the reception means from the first reception mode to the second reception mode, and allows commencement of the reception of a signal of a first signal form.

In the receiver that has such a configuration, upon reception of a signal of a
15 second signal form, the control means controls the switching of the reception means from the first reception mode to the second reception mode having a higher reception rate than that of the first reception mode, and allows commencement of the reception of a signal of a first signal form.

20 Thereby, the receiver is brought in its second reception mode with a high reception rate only when receiving a signal of the first signal form.

Furthermore, in the receiving method according to the present invention, upon the reception of a signal of a second signal form, the mode is switched from a first reception mode to a second reception mode with a reception rate higher than this first reception mode and said signal of a first signal form is received.

25 The signal receiving method allows the receiver to be brought in its second reception mode with a high reception rate only when receiving a signal of the first signal form.

In addition, in order to solve the aforementioned problem, a transmitter according to the present invention comprises a transmission means that transmits signals, and a transmission control means that controls the transmission means so that at the start of transmission, it transmits a signal of a second signal form having a pulse rate lower than a signal of a first signal form, prior to said signal of a first signal form.

In the transmitter of this invention having the above arrangement, the transmission control means controls the transmission means for transmitting signals so that at the start of transmission, it transmits the signal of a second signal form having a pulse rate lower than the signal of a first signal form, prior to said signal of a first signal form.

This transmitter allows the receiver side to be brought in its second reception mode with a high reception rate only when receiving a signal of the first signal form.

In the transmitting method according to the present invention, in order to solve the above-mentioned problem, at the start of transmission, the signal of a second signal form that has a pulse rate lower than the signal of a first signal form is transmitted prior to said signal of a first signal form.

The transmitting method of the invention allows the receiver side to be brought into its second reception mode with a high reception rate only when receiving a signal of the first signal form.

Brief Description of the Drawings

Fig. 1 is a block diagram showing the configuration of a conventional infrared transceiver;

Fig. 2 is a block diagram showing the configuration of a receiver circuit having infrared transceiver module of the infrared transceiver;

Figs. 3A-3C show signal waveforms in the various blocks of the aforementioned receiver circuit;

Fig. 4 is a block diagram showing a configuration of an infrared transceiver which is an embodiment of the present invention;

Fig. 5 is a diagram showing a data protocol adopted in an infrared transceiver system using the aforementioned infrared transceiver on the receiving side;

5 Fig. 6 is a diagram showing mode control commands sent by a CPU to the infrared transceiver module in the aforementioned infrared transceiver; and

Fig. 7 is a flow chart showing the process of changing the mode of the aforementioned infrared transceiver from low-rate reception mode to high-rate reception mode.

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DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Here follows a detailed explanation of an embodiment of the present invention made with reference to drawings. This embodiment shows a receiver according to the present invention, applied to an infrared transceiver that transmits and receives data by using infrared rays in an infrared transceiver system.

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The infrared transceiver is configured such that it receives a signal of a first signal form and a signal of a second signal form that has a lower pulse rate (namely, a lower frequency) than said signal of a first signal form and that is transmitted prior to said signal of a first signal form.

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Specifically, as shown in Fig. 4, the infrared transceiver 1 comprises an infrared transceiver module 2 which is a reception means that receives signals by switching between a first reception mode which is a low-rate reception mode and a second reception mode which is a reception mode with a higher reception rate than the first reception mode, and a microcomputer 3 which is a control means that, upon reception of a signal of a second signal form, controls the switching of the infrared transceiver module 2 from the first reception mode to the second reception mode for commencing the reception of a signal of a first signal form. Moreover, this infrared transceiver 1 also

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comprises an LED (Light Emitting Diode) 4 which serves as the infrared light emitter and a PD (Photo Diode) 5 which serves as the infrared light receiver.

Here, the signals of the first and second signal forms which serve as the protocol (pulse sequence) used in the infrared transceiver system may have forms as shown in

5 Fig. 5, for example.

As shown in Fig. 5, the signal of the first signal form consists of a signal TD that has a high pulse rate (namely, a small pulse width or high frequency), and the signal of the second signal form consists of a signal TG that has a low pulse rate (namely, a large pulse width or low frequency). Moreover, the signal TA lies between the signal TD and
10 the signal TG.

Here, the aforementioned signal TD consists of various information for use in the infrared transceiver 1. Specifically, the signal TD consists of a signal TD1 and a signal TD2, where signal TD1 may be the data required for data analysis and signal TD2 is an end signal that indicates the end of the signal TD in the signal of the first
15 signal form.

In addition, the aforementioned signal TG is a pulse sequence that is transmitted prior to the aforementioned signal TD, or a so-called guide pulse that serves as header information.

Moreover, the aforementioned signal TA has a length of a period sufficient for
20 the operation of switching over from low-rate reception mode to high-rate reception mode.

Signals of such form are transmitted with the signal TG of the second signal form transmitted prior to the signal TD of the first signal form and with signal TA transmitted such that it lies between signal TG and signal TD.

25 Next, we shall describe the various blocks that constitute this infrared transceiver 1.

Referring to Fig. 4 again, the aforementioned infrared transceiver module 2 constitutes a unit that drives the aforementioned LED 4 and performs such signal processing as amplifying the signal received from the PD 5. The infrared transceiver module 2 comprises an amplifier 21 and a receiver circuit (Receiver) 22. The infrared transceiver module 2 may be configured as an analog circuit, for example.

The amplifier 21 is a unit that amplifies the signal output to the aforementioned LED 4. The amplifier 21 amplifies the signal input from the UART 12 of the microcomputer 3, and drives the LED 4 based thereupon. Specifically, the infrared transceiver module 2 uses this amplifier 21 to cause the LED 4 to emit light only when a pulse transmitted from the microcomputer 3 is received. The light emission may require a current of several mA to several dozen mA, for example.

The receiver circuit 22 is a unit that is inputted with the optical signal received by the PD 5. The receiver circuit 22 may have a constitution similar to that of the receiver circuit 122 shown on Fig. 1 and Fig. 2 above. Specifically, it comprises an I/V amplifier 123 for amplifying the optical signals received from the PD 5, a filter 124 that performs the filtering of output signals from this I/V amplifier, a detector 125 that detects output signals from this filter, and a comparator 126 that compares the output signals from this detector against a base value (the "comparator level") and provides output of a logical value of 1 over only the period during which the level of the optical signal exceeds the reference value, and provides output of a logical value of 0 over all other periods.

The infrared transceiver module 2 consisting of such constituent components is constituted such that, based on control signals from the microcomputer 3, it can be switched to one of transmission mode for transmitting data, a reception mode for receiving data and a standby mode used when no communication function is used at all. Moreover, in reception mode the infrared transceiver module 2 has low-rate reception mode for receiving data at a low rate and high-rate reception mode for receiving data at

a high rate. Note that in this embodiment, a half-duplex transmission mode is adopted in which only transmitting or receiving can be performed at one time (both cannot be performed simultaneously).

Here, high-rate reception mode is the reception mode for receiving a signal of the first signal form (signal TD) with a small pulse width. Low-rate reception mode is the reception mode, i.e., a so-called reception standby mode, for receiving signals of the second signal form (signal TG (guide pulse)) with a large pulse width, wherein the current consumption is set lower than that used in high-rate reception mode.

In low-rate reception mode, the infrared transceiver module 2 is on standby for the input of the guide pulse TG with its circuit operation that uses the minimum bias current and the like necessary, namely, with its circuit operation that suppresses current consumption.

The infrared transceiver module 2 is controlled by various control information from the microcomputer 3, and performs such switchovers to the transmission mode, the low-rate reception mode and the high-rate reception mode, and the standby mode based thereupon. Specifically, the microcomputer 3 uses transmission/reception control commands (RX/TX) to switch the infrared transceiver module 2 between the transmission and reception modes, uses the standby control command (STB) to bring the infrared transceiver module 2 in its standby mode, and uses the mode control command (MODE) to switch the infrared transceiver module 2 between low-rate reception mode and high-rate reception mode in a reception mode.

The microcomputer 3 which thus controls the infrared transceiver module 2 comprises a CPU core 11, a UART (Universal Asynchronous Receiver/Transmitter) 12, and a PIO (Parallel I/O) 13, all of which are connected to a data bus 14. The microcomputer 3 is manufactured using the CMOS process and is configured as a so-called single-chip microcomputer.

The aforementioned UART 12 is constituted as a block for transmitting and receiving data to and from the infrared transceiver module 2.

The aforementioned PIO 13 is a parallel I/O that transmits various control commands to the infrared transceiver module 2. The PIO 13 constitutes the interface
5 for control commands to the aforementioned infrared transceiver module 2.

The aforementioned CPU core 11 is constituted such that it has control functions for controlling the various blocks. As described above, this CPU core 11 uses various commands to control the infrared transceiver module 2, and has functions for switching between transmission mode and reception mode, switching the mode between the low-
10 rate reception mode and the high-rate reception mode in the reception mode, and switching the mode to its standby mode. Via the PIO 13, the CPU core 11 controls the various modes of the infrared transceiver module 2 by means of the transmit/receive control commands RX/TX, the standby control command STB and the mode control command MODE.

15 Note that the various control commands may be formed of 2 bits, for example. In this case, the control commands can be allocated in a truth table as shown in Fig. 6, so that for example, standby mode has a value of "00," low-rate reception mode has a value of "01," high-rate reception mode is "10" and transmission mode has a value of "11." Thereby, the control of modes can be carried out not by using 3 bits each of which
20 indicates 1 function = 1 bit, but by using only 2 bits of information.

Fig. 7 specifically shows an example of a series of process steps performed at the time that this CPU core 11 receives data.

First, in Step S1, the CPU core 11 detects whether or not the mode should be in the standby mode in which no communication function is used at all. Here, if the
25 standby mode is confirmed, the CPU core 11 transmits the standby control command STB to the infrared transceiver module 2 to halt all circuits of the infrared transceiver

module 2 and end this process. If not (in normal mode), the CPU core 11 advances to Step S2.

In Step S2, the CPU core 11 determines whether the mode should be in transmission mode or reception mode, and in the case of transmission (TX) mode, it
5 transmits the transmission control command TX to the infrared transceiver module 2 and begins the transmission process in Step S3.

However, if it is determined that the mode should be in reception (RX) mode in Step S2, in Step S4 the CPU core 11 uses the mode control command MODE to set the infrared transceiver module 2 to low-rate reception mode. Thereby, the infrared
10 transceiver module 2 is brought in the state in which it is able to receive the signal TG.

Regarding the receipt of the signal TG, in the following Step S5 the CPU core 11 determines whether or not the signal TG has been detected. Here the CPU core 11 awaits the input of the guide pulse which is the signal TG.

Upon confirming the input of the signal TG, the CPU core 11 proceeds to Step
15 S6 and uses the mode control command MODE to set the infrared transceiver module 2 to its high-rate reception mode. Only then does the infrared transceiver module 2 increase the current consumption and receive the data consisting of high-rate pulses called the signal TD. It is determined that the time required for the operation of switching from low-rate reception mode to high-rate reception mode is stipulated to be
20 within the length of the signal TA described above.

In the high-rate reception mode, the CPU core 11 awaits the input of the signal TD1 in the subsequent Step S7. Here in Step S8, upon confirming the input of the signal TD1, the CPU core 11 performs data analysis on the data consisting of the signal TD1. In the data analysis, data processing is performed on the data consisting of the
25 received signal TDI.

In the subsequent Step S9, upon detecting the end signal TD2, the CPU core 11 is triggered to return to the first step in this process, namely, the aforementioned Step S1.

The infrared transceiver 1 configured as above performs the processes of transmitting and receiving data. Moreover, the infrared transceiver 1 performs the reception of data by switching between the low-rate reception mode and the high-rate reception mode in data reception mode. Specifically, the infrared transceiver 1 is
5 always brought in the receive standby state in low-rate reception mode except when, in reception mode, the signal TD is received.

In passing, in a conventional infrared transceiver the microcomputer is formed of a digital circuit manufactured by the CMOS process, so its current consumption is extremely low. Moreover, the power consumption tends to become even lower as the
10 circuit patterns in the process becomes more minute and necessary voltage is reduced. However, the infrared transceiver module is formed of an analog circuit typically manufactured by the bipolar process, so its current consumption is relatively large and unlikely to benefit from advances in CMOS processes. In addition, since module is connected to the LED and PD, specific specifications must be satisfied so it is difficult
15 to decrease the current.

However, even among these infrared transceiver modules, since only the driver for driving the LED on the transmitting side is an analog circuit, the current flows only during the instant that the LED is made to emit light and no current flows during other periods. When the LED emits light, a current of several mA to several dozen mA must
20 flow, but the actual period over which this current flows is only when a transmit pulse from the microcomputer is received, so the total power consumption is prevented from becoming so large.

However, in the receive circuit on the receiving side, a constant bias current or base current continues to flow throughout all the circuits regardless of whether or not a
25 valid pulse is received. Specifically, a constant current is consumed in the reception standby state even if a valid pulse is not actually being received.

On the other hand, when the communication system is half-duplex system in which either of transmission and reception is performed at one time, it is possible to halt one of the transmission or reception circuits using the transmission/reception control commands RX/TX from the microcomputer, or if no communication function is to be used at all, the standby control command STB from the microcomputer can be used to halt all circuits in the infrared transceiver module. However, since the apparatus is brought in its reception standby state for most of time when it is set in its communication mode, the current consumption in the receive circuit becomes the bottleneck for reducing the power consumption of the entire system. Moreover, since increase of the transmission rate requires high-rate pulse response, so a problem occurs in that the constant current in the receive circuit must be made large.

By adopting the configuration described above, the infrared transceiver 1 according to the present invention solves all of these problems. The transceiver is brought in its low-rate reception mode in the receive standby state, thus making the current consumption of the entire system small and brought in its state that the data can be received at high rate, by switching to high-rate reception mode immediately after receipt of the guide pulse TG. Thus, it is possible to achieve high signal transmission speeds.

Thereby, since the infrared transceiver 1 also has, in addition to switching of the communication mode ON/OFF and transmission/reception control, the high-rate/low-rate control during reception, current consumption can be greatly reduced during reception standby mode, so the power consumption of an entire system equipped with infrared communication functions can be reduced and thus longer battery life can be achieved.

Note that in the processing shown in Fig. 7, the processing in each decision step need not be performed in a predetermined processing order, but in an optional order based on interrupt signals.

In addition, while the two-stage switching using the guide pulse (signal TG) and data (signal TD) is described in the embodiment, the same concept as in the present invention can be utilized even in the case of adopting a scheme for switching among three or more stages corresponding to multiple systems in which the transmission rate is different for each of a plurality of different guide pulses and a plurality of different types of data. In this case, the infrared transceiver 1 receives a signal TG corresponding to each of a plurality of individual signals TD and the microcomputer 3 properly switches the reception rate in high-rate reception mode depending on the form of the signal TG. Then, the reception of the signal TD transmitted subsequently is performed.

In addition, the constitution of the infrared transmitter side that transmits signals to the aforementioned infrared transceiver 1 according to the predetermined protocol comprises a transmission means that transmits signals, and a transmission control means that controls this transmission means so that at the start of transmission, it transmits a signal of a second signal form that has a pulse rate lower than a signal of a first signal form and that is transmitted prior to said signal of a first signal form. In the infrared transceiver, the transmission control means controls the transmission means that transmits signals so that at the start of transmission, it transmits the aforementioned signal TG which is the signal of a second signal form that has a pulse rate lower than the signal TD which is a signal of a first signal form and that is transmitted prior to said signal TD.

Thereby, the infrared transceiver can transmit the signals used as protocol shown in the Fig. 5. Here, the transmission control means is constituted as one function of the microcomputer that controls the various blocks of this infrared transceiver, and the transmission means is provided with a driving means that drives the LED and is constituted as a transmission processing block that transmits signals to the infrared transceiver 1.

The transceiving method according to the present invention has a transmission step wherein, at the start of transmission, a signal of a second signal form that has a pulse rate lower than a signal of a first signal form is transmitted prior to said signal of a first signal form, and a reception step wherein, upon the reception of a signal of a second signal form, the mode is switched from a first reception mode to a second reception mode with a reception rate higher than this first reception mode and the signal of a first signal form is received. Therefore, a signal of a second signal form is transmitted prior to the signal of a first signal form in the transmission step, and said signal of a second signal form is received in the reception step, so switching from the first reception mode to the second reception mode in order to receive a signal of a first signal form can be performed.

By the transceiving method of the present invention, the reception means that receives signals can be set to a second reception mode with a high reception rate only when receiving a signal of the first signal form.

15 Thereby, the receiver can perform high-rate communications while also reducing the current consumption in the reception of data.

The receiver according to the present invention comprises a reception means that receives signals by switching between a first reception mode and a second reception having a higher reception rate than this first reception mode, and a control means that, upon reception of a signal of a second signal form, controls the switching of the reception means from the first reception mode to the second reception mode, and allows commencement of the reception of a signal of a first signal form. Therefore, upon reception of a signal of a second signal form, the control means can use a mode switching signal for switching between the first reception mode and the second reception mode with a higher reception rate than this first reception mode to control the switching of the reception means from the first reception mode to the second reception mode, and allows commencement of the reception of a signal of a first signal form.

Thereby, the receiver can be brought in its second reception mode with a high reception rate only when receiving a signal of the first signal form, and thus, the receiver can perform high-rate communications while also reducing the current consumption in the reception of data.

5 In the receiving method of the present invention, upon the reception of a signal of a second signal form, the mode is switched from a first reception mode to a second reception mode with a reception rate higher than this first reception mode and said signal of a first signal form is received. Therefore, the receiver can be brought in its second reception mode with a high reception rate only when receiving a signal of the
10 first signal form, and thus, the receiver can perform high-rate communications while also reducing the current consumption in the reception of data.

 The transmitter of the present invention comprises a transmission means that transmits signals, and a transmission control means that controls the transmission means so that at the start of transmission, it transmits a signal of a second signal form that has a
15 pulse rate lower than a signal of a first signal form and that is transmitted prior to said signal of a first signal form, and thereby, the transmission control means controls the transmission means that transmits signals so that at the start of transmission, it can transmit the signal of a second signal form that has a pulse rate lower than the signal of a first signal form and that is transmitted prior to said signal of a first signal form.

20 The transmitter allows the receiver side to be brought in the second reception mode with a high reception rate only when receiving a signal of the first signal form. Therefore, the receiver can perform high-rate communications while also reducing the current consumption in the reception of data.

 In the transmitting method of the present invention, at the start of transmission,
25 by transmitting the signal of a second signal form that has a pulse rate lower than the signal of a first signal form and that is transmitted prior to said signal of a first signal

form, the receiver side can be brought in the second reception mode with a high reception rate only when receiving a signal of the first signal form.

Thereby, the receiver can perform high-rate communications while also reducing the current consumption in the reception of data.

CLAIMS

What is Claimed is:

1. A transceiver comprising:

5 a transmission means that transmits a signal of a second signal form that has a pulse rate lower than a signal of a first signal form and which is transmitted prior to said signal of a first signal form; and

a reception means that, upon reception of said signal of a second signal form, receives said signal of a first signal form by switching a mode from a first reception
10 mode to a second reception mode which is a reception mode with a higher reception rate than said first reception mode.

2. The transceiver recited in Claim 1, wherein

at the end of transmission of said signal of a first signal form, said transmission
15 means transmits said signal including an end signal that indicates an end of said signal of a first signal form, and

upon receipt of said end signal, said reception means switches a mode to said first reception mode.

20 3. The transceiver recited in Claim 1, wherein a current consumption of said reception means in said first reception mode is set smaller than the current consumption of said reception means in said second reception mode.

4. A transceiver comprising:

25 a transmission means that selectively, as a pair, transmits a plurality of information signals having different pulse rates and a plurality of guide signals which



respectively correspond to said plurality of information signals and which are transmitted prior to the transmission of the information signals, and

a reception means that, upon receipt of each of said guide signals, switches a mode from a reception standby mode to a reception mode corresponding to the pulse
5 rate of the information signal paired with said guide signal, and receives said information signal.

5. A signal transceiving method comprising:

a transmission step wherein, at the start of transmission, a signal of a second
10 signal form that has a pulse rate lower than a signal of a first signal form is transmitted prior to said signal of a first signal form, and

a reception step wherein, upon the reception of a signal of said second signal form, the mode is switched from a first reception mode to a second reception mode with a reception rate higher than said first reception mode and said signal of a first signal
15 form is received.

6. The transceiving method recited in Claim 5, wherein

in said transmission step, at the end of transmission of said signal of a first signal form, an end signal that indicates an end of this signal of a first signal form is
20 included in said signal of a first signal form, and

in said reception step, upon the receipt of said end signal, a switch to said first reception mode is performed.

7. The transceiving method recited in Claim 5, wherein

a current consumption of said reception means that receives signals by said
25 reception step in said first reception mode is smaller than the current consumption of said reception means in said second reception mode.



* C L M S *

8. A receiver that receives a signal of a first signal form, and a signal of a second signal form that has a pulse rate lower than this signal of a first signal form that is sent prior to said signal of a first signal form, comprising:

5 a reception means that receives signals by switching between a first reception mode and a second reception mode having a higher reception rate than this first reception mode, and

a control means that, upon reception of a signal of a second signal form, controls the switching of the reception means from the first reception mode to the second
10 reception mode, and initiates the reception of a signal of a first signal form.

9. The receiver recited in Claim 8, wherein

upon receipt of an end signal that indicates the end of said signal of a first signal form that is included in said signal of a first signal form, said control means switches a
15 mode to said first reception mode.

10. The receiver recited in Claim 8, wherein a current consumption of said reception means in said first reception mode is set smaller than the current consumption of said reception means in said second reception mode.

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11. The receiver recited in Claim 8, wherein the reception means at the start of transmission, receives a signal of a second signal form prior to said signal of a first signal form.

25 12. The receiver recited in Claim 8, which receives signals by using infrared rays.



13. A signal reception method for receiving a signal of a first signal form, and a signal of a second signal form that has a pulse rate lower than this signal of a first signal form that is transmitted prior to said signal of a first signal form, comprising the steps of:

5 controlling, upon reception of said signal of a second signal form, switching a mode from the first reception mode to the second reception mode to thereby allow commencement of the reception of a signal of a first signal form.

14. A signal transmitter comprising:

10 a transmission means that transmits signals; and

a transmission control means that controls said transmission means so that at the start of transmission, it transmits a signal of a second signal form that has a pulse rate lower than a signal of a first signal form and that is transmitted prior to said signal of a first signal form.

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15. The transmitter recited in Claim 14, wherein

at the end of transmission of said signal of a first signal form, said transmission means transmits the signal of a first signal form with an end signal that is included in said signal and that indicates the end of this signal of a first signal form.

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16. The transmitter recited in Claim 14, which receives signals by using infrared rays.

17. A signal transmission method, wherein at the start of transmission, a signal of a second signal form that has a pulse rate lower than a signal of a first signal form is transmitted prior to said signal of a first signal form.

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