

APPENDIX B: TECHNICAL INFORMATION

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1. OUTPUT FORMAT FOR HOST COMPUTER

The bit serial voltage type, which conforms to the RS-232C interface, is used for host computer output of the KX-21N. The serial interface port for the connection with the host computer is on the rear panel of the main unit.

1.1 Hardware

1. Connector

- The connector for the output to the host computer is located on the rear panel.
- Use a 9-pin D-SUB, female connector.
- Fixing screws for this connector are in inch-specification.

2. Connector Signals

| Pin No. | Signal Name | Signal Direction |
|---------|---------------------------|---------------------|
| 1 | | |
| 2 | Receive data (R×D) | From Host to KX-21N |
| 3 | Transmit Data (T×D) | To Host from KX-21N |
| 4 | Data Terminal Ready (DTR) | To Host from KX-21N |
| 5 | Signal Ground (SG) | |
| 6 | Data Set Ready (DSR) | From Host to KX-21N |
| 7 | Request to Send (RTS) | To Host from KX-21N |
| 8 | Clear to Send (CTS) | From Host to KX-21N |
| 9 | | |

Table B-1-1: Pin Assignment

3. Communication Format

The data is communicated in the asynchronous, full duplex mode.

4. Signal Level

Signal level conforms to JIS C6361.

| Level | Data signal | Control signal |
|---------------|----------------------|----------------|
| +3V or higher | Logic "1", Start bit | ON |
| -3V or lower | Logic "0", Stop bit | OFF |

Table B-1-2: Signal Level

5. Interface Circuit

- Output circuit

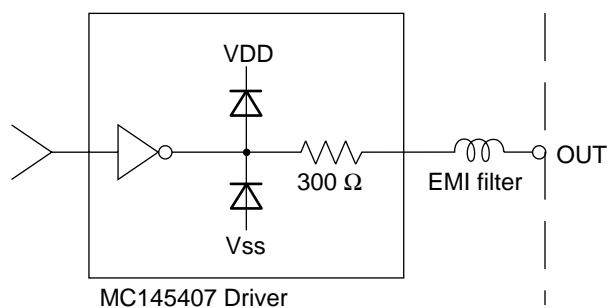


Figure B-1-1: Interface Output Circuit

- Input circuit

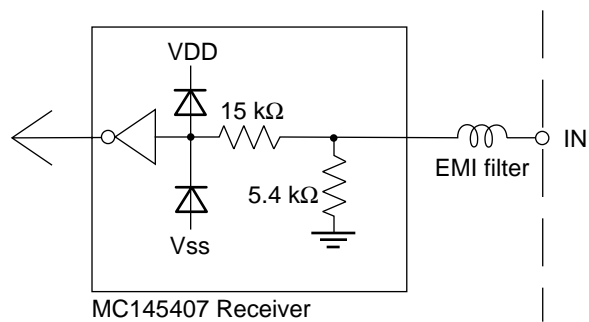


Figure B-1-2: Interface Input Circuit

1.2 Software

1. Communication Format

1) Code

ASCII codes are used for output.
(Except for K-DPS output)

2) Structure of text

"STX" (02 H) is sent prior to data and "ETX" (03 H) is sent at the end of data.
(Except for K-DPS output)

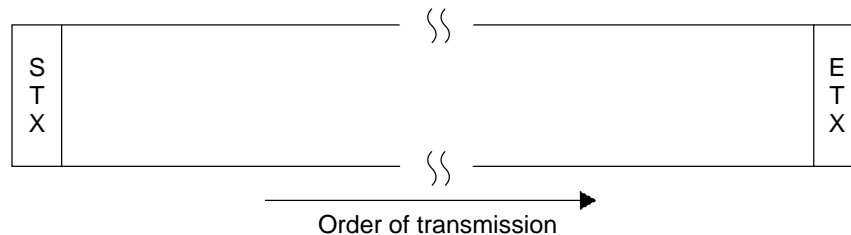


Figure B-1-3: Order of Transmission

3) Communication protocol

The following 2 protocols are provided in the system, and can be selected according to the system status.

- **Class A**

One-way transmission to the host computer without requiring ACK nor NAK from host computer.

- **Class B**

The KX-21N transmits data and then waits for ACK or NAK to complete the data transmission.

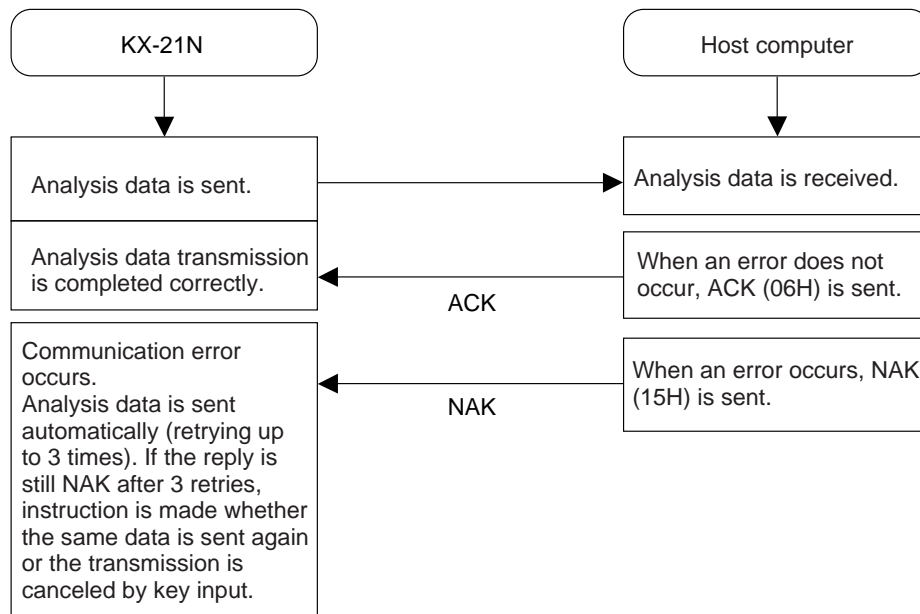


Figure B-1-4: Data Transmission

4) Transmission errors

If the KX-21N detects a transmission error, the data transmission is canceled and an error message is displayed. Re-transmission of the data ([1] key) or cancellation of the transmission ([3] key) can be selected. Transmission errors occur in the following situations.

- The computer is off line.
- The control signal DSR is off.
- After the data is transmitted, there is no response from the computer in 15 seconds. (Class B only)
- After the data is transmitted, other than ACK or NAK is sent from the computer. (Class B only)
- After the data is transmitted, the fourth NAK is sent. (Class B only. The KX-21N resends the data automatically up to 3 times when NAK is sent.)

5) Timing, subject, and content of transmission

| | |
|-----------------|--|
| | Serial interface ↓ Host computer |
| Normal analysis | Analysis data (A) |
| Quality control | QC data (A) |

Table B-1-3: Content of Transmission

- Analysis data includes the date, sample ID No., parameter data, and the flag.
- QC data is \bar{X} or L-J data.
- The setting of the connecting device is changed in the setting program.

2. Text Format

The following three types of formats are used for computer output.

- KX-21N: Format for connecting to the host computer
- K-1000: Format for connecting to the host computer
- K-DPS: Special format for connecting to K-DPS

NOTE: • KX-21N format is selected at the time of shipping from the factory.

The details of KX-21N and K-1000 format are as follows.

- KX-21N format
KX-21N format has two formats; one is "analysis data format" for output of the sample data, and the other is "QC data format" for output of the QC data. They differ in length and content of the text. (They are distinguished by the sample distinction code.)
The text distinction code II is fixed at "1".
However, when the text exceeds 256 bytes in a future modification, the text is divided into 2 or more blocks. The number in text distinction code II shows the order of the blocks. The ETB (17 H) is not used.

(1) Analysis data format

| Parameter | No. of Characters | Example |
|----------------------------|-------------------|-------------------|
| STX | 1 | (02 H) |
| Text distinction code I | 1 | "D" |
| Text distinction code II | 1 | "1" |
| Sample distinction code | 1 | "U" |
| Year | 4 | "1999" |
| Month | 2 | "09" |
| Day | 2 | "30" |
| Analysis information | 1 | (O) |
| Sample ID No. | 15 | (OOOOOOOOOOOOOOO) |
| PDA information | 6 | (OOOOOO) |
| Reserve | 1 | "O" |
| WBC [×10 ³ /μL] | 5 | XXX.XF |
| RBC [×10 ⁶ /μL] | 5 | XX.XXF |
| HGB [g/dL] | 5 | XXX.XF |
| HCT [%] | 5 | XXX.XF |
| MCV [fL] | 5 | XXX.XF |
| MCH [pg] | 5 | XXX.XF |
| MCHC [g/dL] | 5 | XXX.XF |
| PLT [×10 ³ /μL] | 5 | XXXXF |
| LYM% (W-SCR) | 5 | XXX.XF |
| MXD% (W-MCR) | 5 | XXX.XF |
| NEUT% (W-LCR) | 5 | XXX.XF |
| LYM# (W-SCC) | 5 | XXX.XF |
| MXD# (W-MCC) | 5 | XXX.XF |
| NEUT# (W-LCC) | 5 | XXX.XF |
| RDW-SD [fL] | 5 | XXX.XF |
| RDW-CV [%] | 5 | XXX.XF |
| PDW [fL] | 5 | XXX.XF |
| MPV [fL] | 5 | XXX.XF |
| P-LCR [%] | 5 | XXX.XF |
| ETX | 1 | (03 H) |
| Total 131 | | |

Table B-1-4: Analysis Data Format

(2) QC data format

| Parameter | No. of Characters | Example |
|---|-------------------|------------|
| STX | 1 | (02 H) |
| Text distinction code I | 1 | "D" |
| Text distinction code II | 1 | "1" |
| Sample distinction code | 1 | "C" |
| Data distinction code | 1 | "X" or "L" |
| Year | 4 | "1999" |
| Month | 2 | "09" |
| Day | 2 | "30" |
| Hour | 2 | "09" |
| Minute | 2 | "59" |
| QC File Number | 1 | "5" |
| Not used | 1 | "0" |
| Reserve | 1 | "0" |
| WBC $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| LYM% (W-SCR) [%] | 4 | XXX.X |
| MXD% (W-MCR) [%] | 4 | XXX.X |
| NEUT% (W-LCR) [%] | 4 | XXX.X |
| LYM# (W-SCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| MXD# (W-MCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| NEUT# (W-LCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| RBC $[\times 10^6/\mu\text{L}]$ | 4 | XX.XX |
| HGB [g/dL] | 4 | XXX.X |
| HCT [%] | 4 | XXX.X |
| MCV [fL] | 4 | XXX.X |
| MCH [pg] | 4 | XXX.X |
| MCHC [g/dL] | 4 | XXX.X |
| RDW- SD [fL] | 4 | XXX.X |
| RDW- CV [%] | 4 | XXX.X |
| PLT $[\times 10^3/\mu\text{L}]$ | 4 | XXXX |
| PDW [fL] | 4 | XXX.X |
| MPV [fL] | 4 | XXX.X |
| P-LCR [%] | 4 | XXX.X |
| W-SMV [fL] | 4 | XXX.X |
| W-LMV [fL] | 4 | XXX.X |
| ETX | 1 | (03 H) |
| Total 105 | | |

Table B-1-5: QC data format

- (3) Details of the analysis data output in KX-21N format
 - 1) The order of output is from the top parameter to the bottom. The data is sent from the upper line without performing zero suppression.
 - 2) Because the decimal point is not sent, the decimal point specified in each parameter has to be added and represented by numeric value at the host computer.
 - 3) Analysis information shows the following content of the analysis.

| | Manual No. input |
|---------------------------|------------------|
| WB mode analysis | "0" |
| Pre-diluted mode analysis | "5" |

Table B-1-6: Analysis Information

- 4) PDA information consists of the following 6 items.

| Item | No. of Characters |
|---------------------------|-------------------|
| WBC histogram information | 1 |
| WBC histogram flag | 1 |
| RBC histogram information | 1 |
| RBC histogram flag | 1 |
| PLT histogram information | 1 |
| PLT histogram flag | 1 |

Table B-1-7: PDA Information

| Code | Description |
|------|------------------------|
| "0" | Histogram is normal. |
| "1" | Histogram is abnormal. |
| "2" | Manually discriminated |

Table B-1-8: Histogram Information

| Code | Description |
|------|---|
| "0" | Normal WBC/RBC/PLT |
| "1" | (L) discriminator degree is high. WBC/RBC/PLT |
| "2" | (U) discriminator degree is high. WBC/RBC/PLT |
| "3" | Analysis is impossible because there is no pair of intersection on the 20% degree level for calculation of DW. RBC/PLT |
| "4" | Two peaks are recognized in the particle distribution. RBC/PLT |
| "5" | (T1) discriminator cannot be determined. WBC |
| "6" | (T2) discriminator cannot be determined. WBC |
| "7" | (T1) discriminator level is high, and the data is not reliable. WBC |
| "8" | (T1) or (T2) discriminator level is high, and the data is not reliable. WBC |
| "9" | (T2) discriminator level is high, and the data is not reliable. WBC |
| "A" | The particle count equal to or less than (L) discriminator exceeds the range. WBC |

Table B-1-9: Histogram Flag

The histogram flag corresponds to the flagging characters of the LCD and the printer as follows.

| Particle distribution | Flagging characters of LCD and printer | | |
|-----------------------|--|-----|-----|
| FLAG | WBC | RBC | PLT |
| "0" | | | |
| "1" | WL | RL | RL |
| "2" | WU | RU | RU |
| "3" | | DW | DW |
| "4" | | MP | MP |
| "5" | T1 | | |
| "6" | T2 | | |
| "7" | F1 | | |
| "8" | F2 | | |
| "9" | F3 | | |
| "A" | | | AG |

Table B-1-10: Flagging Character

- 5) The numerical data configuration in the Analysis Data Format is as follows.

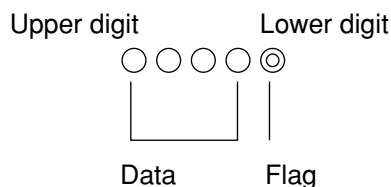


Figure B-1-5: Numerical Data Configuration

| Code | Description |
|------|------------------------------|
| "0" | Normal |
| "1" | Abnormality judgment is "+." |
| "2" | Abnormality judgment is "-." |
| "3" | Out of linearity limit |
| "4" | Reliability is low. |

Table B-1-11: Details of Flag

- 6) If the data over-flows, it is indicated as follows:
*0003
- 7) In case of analysis error, or if the data lacks some data such as the calculation parameter in pre-diluted mode, the data is transmitted as follows:
*0000
- K-1000 format
K-1000 format has two formats; one is "analysis data format" for output of the sample data, and the other is "QC data format" for output of the QC data. They differ in length and content of the text. (They are distinguished by the sample distinction code.)
The text distinction code II is fixed at "1".
However, when the text exceeds 256 bytes in a future modification, the text is divided into 2 or more blocks. The number in text distinction code II shows the order of the blocks. The ETB (17 H) is not used.

(1) Analysis data format

| Parameter | No. of Characters | Example |
|----------------------------|-------------------|-----------------|
| STX | 1 | (02 H) |
| Text distinction code I | 1 | "D" |
| Text distinction code II | 1 | "1" |
| Sample distinction code | 1 | "U" |
| Year | 2 | "99" |
| Month | 2 | "09" |
| Day | 2 | "30" |
| Analysis information | 1 | (O) |
| Sample ID No. | 12 | (OOOOOOOOOOOOO) |
| PDA information | 6 | (OOOOOO) |
| RDW select information | 1 | "S" or "C" |
| WBC [×10 ³ /μL] | 5 | XXX.XF |
| RBC [×10 ⁶ /μL] | 5 | XX.XXF |
| HGB [g/dL] | 5 | XXX.XF |
| HCT [%] | 5 | XXX.XF |
| MCV [fL] | 5 | XXX.XF |
| MCH [pg] | 5 | XXX.XF |
| MCHC [g/dL] | 5 | XXX.XF |
| PLT [×10 ³ /μL] | 5 | XXXXF |
| LYM% (W-SCR) | 5 | XXX.XF |
| MXD% (W-MCR) | 5 | XXX.XF |
| NEUT% (W-LCR) | 5 | XXX.XF |
| LYM# (W-SCC) | 5 | XXX.XF |
| MXD# (W-MCC) | 5 | XXX.XF |
| NEUT# (W-LCC) | 5 | XXX.XF |
| RDW-SD/CV [fL/%] | 5 | XXX.XF |
| PDW [fL] | 5 | XXX.XF |
| MPV [fL] | 5 | XXX.XF |
| P-LCR [%] | 5 | XXX.XF |
| ETX | 1 | (03 H) |
| Total 121 | | |

Table B-1-12: Analysis Data Format

(2) QC data format

| Parameter | No. of Characters | Example |
|---|-------------------|------------|
| STX | 1 | (02 H) |
| Text distinction code I | 1 | "D" |
| Text distinction code II | 1 | "1" |
| Sample distinction code | 1 | "C" |
| Data distinction code | 1 | "X" or "L" |
| Year | 2 | "97" |
| Month | 2 | "09" |
| Day | 2 | "30" |
| Hour | 2 | "09" |
| Minute | 2 | "59" |
| QC File Number | 1 | "5" |
| Not used | 1 | "0" |
| RDW select information | 1 | "C" |
| WBC $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| LYM% (W-SCR) [%] | 4 | XXX.X |
| MXD% (W-MCR) [%] | 4 | XXX.X |
| NEUT% (W-LCR) [%] | 4 | XXX.X |
| LYM# (W-SCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| MXD# (W-MCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| NEUT# (W-LCC) $[\times 10^3/\mu\text{L}]$ | 4 | XXX.X |
| RBC $[\times 10^6/\mu\text{L}]$ | 4 | XX.XX |
| HGB [g/dL] | 4 | XXX.X |
| HCT [%] | 4 | XXX.X |
| MCV [fL] | 4 | XXX.X |
| MCH [pg] | 4 | XXX.X |
| MCHC [g/dL] | 4 | XXX.X |
| RDW-(CV/SD) [%/fL] | 4 | XXX.X |
| PLT $[\times 10^3/\mu\text{L}]$ | 4 | XXXX |
| PDW [fL] | 4 | XXX.X |
| MPV [fL] | 4 | XXX.X |
| P-LCR [%] | 4 | XXX.X |
| W-SMV [fL] | 4 | XXX.X |
| W-LMV [fL] | 4 | XXX.X |
| ETX | 1 | (03 H) |
| Total 99 | | |

Table B-1-13: QC data format

- (3) Details of the analysis data output in K-1000 format
- 1) The order of output is from the top parameter to the bottom. The data is sent from the upper line without performing zero suppression.
 - 2) Because the decimal point is not sent, the decimal point specified in each parameter has to be added and represented by numeric value at the host computer.
 - 3) Analysis information shows the following content of the analysis.

| | Manual No. input |
|---------------------------|------------------|
| WB mode analysis | "0" |
| Pre-diluted mode analysis | "5" |

Table B-1-14 Analysis Information

- 4) The sample ID No. is 15-digit numerals, but 12 digits are output in this format. The upper 3 digits are deleted. Depending on the usage, "-" (2D H) may be inserted in the numeral column. In this case, "-" is included in the 12 digits.
- 5) PDA information consists of the following 6 items.

| Item | No. of Characters |
|---------------------------|-------------------|
| WBC histogram information | 1 |
| WBC histogram flag | 1 |
| RBC histogram information | 1 |
| RBC histogram flag | 1 |
| PLT histogram information | 1 |
| PLT histogram flag | 1 |

Table B-1-15: PDA Information

| Code | Description |
|------|------------------------|
| "0" | Histogram is normal. |
| "1" | Histogram is abnormal. |
| "2" | Manually discriminated |

Table B-1-16: Histogram Information

| Code | Description |
|------|---|
| "0" | Normal WBC/RBC/PLT |
| "1" | (L) discriminator degree is high. WBC/RBC/PLT |
| "2" | (U) discriminator degree is high. WBC/RBC/PLT |
| "3" | Analysis is impossible because there is no pair of intersection on the 20% degree level for calculation of DW. RBC/PLT |
| "4" | Two peaks are recognized in the particle distribution. RBC/PLT |
| "5" | (T1) discriminator cannot be determined. WBC |
| "6" | (T2) discriminator cannot be determined. WBC |
| "7" | (T1) discriminator level is high, and the data is not reliable. WBC |
| "8" | (T1) or (T2) discriminator level is high, and the data is not reliable. WBC |
| "9" | (T2) discriminator level is high, and the data is not reliable. WBC |
| "A" | The particle count equal to or less than (L) discriminator exceeds the range. WBC |

Table B-1-17: Histogram Flag

The histogram flag corresponds to the flagging characters of the LCD and the printer as follows.

| Particle distribution | Flagging characters of LCD and printer | | |
|-----------------------|--|-----|-----|
| FLAG | WBC | RBC | PLT |
| "0" | | | |
| "1" | WL | RL | RL |
| "2" | WU | RU | RU |
| "3" | | DW | DW |
| "4" | | MP | MP |
| "5" | T1 | | |
| "6" | T2 | | |
| "7" | F1 | | |
| "8" | F2 | | |
| "9" | F3 | | |
| "A" | | | AG |

Table B-1-18: Flagging Character

- 6) RDW select information
It shows whether RDW-CV or RDW-SD is output.
"C": RDW-CV
"S": RDW-SD

NOTE:

- RDW-SD is selected at the initial setting of K-1000.
- To output RDW-CV, refer to *Chapter 10, Section 6: HOST SETTINGS*.

- 7) The numerical data configuration in the Analysis Data Format is as follows.

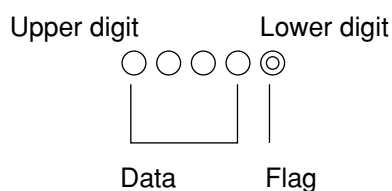


Figure B-1-6: Numerical Data Configuration

| Code | Description |
|------|------------------------------|
| "0" | Normal |
| "1" | Abnormality judgment is "+." |
| "2" | Abnormality judgment is "-." |
| "3" | Out of linearity limit |
| "4" | Reliability is low. |

Table B-1-19: Details of Flag

- 8) If the data over-flows, it is indicated as follows:
*0003
- 9) In case of analysis error, or if the data lacks some data such as the calculation parameter in pre-diluted mode, the data is transmitted as follows:
*0000

2. HAND HELD BAR CODE READER SPECIFICATIONS

1. Hardware Specifications

1) Specification

- (1) The kind of Bar Code: UPC-A, UPC-E, CODE39, CODE128, ITF, NW-7
- (2) Decoder: Built-in a reading head.
- (3) Interface: RS-232C
- (4) Connector: DIN 8P
- (5) Power Supply: DC5V+/-5%

2) Pin Arrangement of Connector (DIN 8P)

| Pin No. | Signal name | | Direction of signal |
|---------|-------------|---------------------|---------------------|
| 1 | TXD | Transmitting Data | to HOST |
| 2 | RXD | Receiving Data | from HOST |
| 3 | RTS | Request to Send | to HOST |
| 4 | CTS | Clear to Send | from HOST |
| 5 | NC | | |
| 6 | DTR | Data Terminal ready | to HOST |
| 7 | SG | Signal Ground | |
| 8 | +5V | | from HOST |

3) Data Transmission Procedure

PRE (ID) DATA POST
PRE: STX
POST: ETX

2. Software Specifications

1) Communication Protocol

| | |
|-----------|--------------|
| Baud Rate | 2400 |
| Code | 7-bit |
| Stop Bit | 2-bit |
| Parity | Even |
| RTS/CTS | Use |
| Protocol | None |
| Preamble | Transmit STX |
| Postamble | Transmit ETX |

2) Protocol
RTS/CTS Effective
Non Protocol

3) Format
STX DATA ETX

4) The Kind of Bar Code

- (1) CODE39
Data can be transmitted without Check Digits, since Check Digits (MOD-43) is judged within Bar Code Reader.
All data may be transmitted with Check Digits, but with no-effect.
- (2) JAN, UPC-A, UPC-E, EAN13, EAN8
Data can be transmitted without Check Digits, since Check Digits (MOD-10) is judged within Bar Code Reader.
- (3) NW-7
Data can be transmitted without Check Digits, since Check Digits (MOD-16) is judged within Bar Code Reader.
All data except Start/Stop Code may be transmitted by the setup of the Check Digits, but with no-effect.
- (4) ITF
Data can be transmitted without Check Digits, since Check Digits (MOD-10) is judged within Bar Code Reader.
All data may be transmitted with Check Digits, but with no-effect.
- (5) CODE128
Data can be transmitted without Check Digits, since Check Digits (MOD-103) is judged within Bar Code Reader.

3. Setting for Each Bar Code Symbology

Set the optional manual ID Bar Code Reader, as specified for each bar code symbology.

- 1) Code39
Check Digit=Use
Check Digit=Not transmit
ST/SP=Not transmit
Full ASCII=Non
Multi-read=No
ID Character=Not transmit

- 2) NW-7
 - Check Digit=Not transmit
 - ST/SP=Not transmit
 - ST/SP Character=a, b, c, d
 - Hex Format=No
 - ID Character=Not transmit
- 3) UPC-A, UPC-E, EAN13, EAN8
 - Check Digit=Not transmit
 - Add-On=No
 - ID Character=Not transmit
- 4) ITF
 - Check Digit=Not transmit
 - ID Character=Not transmit
- 5) Code128
 - Check Digit=Use
 - Check Digit=Not transmit
 - ID Character=Not transmit