

传感器计量技术要求（R76）整理

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0.4	2020.03.19	Draft	Add C1,C2,C6 calibration	CLF
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References

[1]

1. 计量技术要求

1.1 容量和显示分度 Capacity and display interval

容量 MAX，例如 6.000 kg

显示分度 e，例如 0.002 kg

对应的 SICS 指令：

Command	Example
I38	I38 A 1 0.040 6.000 0.002 0.002 3 kg // 标黄对应 MAX，标绿对应 e
XP0339	XP0339 A 3 -0.04 6.018 1 // 标绿对应 e
XP0910	XP0910 A 6.0 //对应 MAX

1.2 最小容量（加载） Minimum capacity/load

Minimum load (R76 Minimum capacity): 20e

3.2 Classification of instruments

The verification scale interval, number of verification scale intervals and the minimum capacity, in relation to the accuracy class of an instrument, are given in Table 3.

Table 3

Accuracy class	Verification scale interval, <i>e</i>	Number of verification scale intervals, <i>n</i> = Max/ <i>e</i>		Minimum capacity, Min (Lower limit)
		minimum	maximum	
Special (I)	0.001 g ≤ <i>e</i> *	50 000**	—	100 <i>e</i>
High (II)	0.001 g ≤ <i>e</i> ≤ 0.05 g	100	100 000	20 <i>e</i>
	0.1 g ≤ <i>e</i>	5 000	100 000	50 <i>e</i>
Medium (III)	0.1 g ≤ <i>e</i> ≤ 2 g	100	10 000	20 <i>e</i>
	5 g ≤ <i>e</i>	500	10 000	20 <i>e</i>
Ordinary (III)	5 g ≤ <i>e</i>	100	1 000	10 <i>e</i>

对应的 SICS 指令：

Command	Example
I38	I38 B 1 0.040 6.000 0.002 0.002 3 kg // 标黄对应Minimum load I38 A 2 0.100 15.000 0.005 0.005 3 kg // 标黄对应 Minimum load
XP0909	XP0909 B 0 0.1 //标黄对应Minimum load XP0909 B 1 0.04 //标黄对应Minimum load XP0909 A 2 0.0

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI
XP0909	20e-0.5e XP0909 B 0 0.039	20e XP0909 B 0 0.04

1.3 称重超载上限 Over load status (exceeds the limits of indication)

$\leq \text{Max}+9e(\text{OIML})$

$\leq \text{Max}+9e$ or $\leq 105\%\text{Max}(\text{NTEP 一般衡器})$

$\leq \text{Max}+9e(\text{NTEP 计价衡器})$

对应的 SICS 指令：

Command	Example
I61	I61 A -0.040 5.018 kg //标绿对应 Max+9e
XP0339	XP0339 A 3 -0.04 5.018 2 1 // 标绿对应 Max+9e

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI
XP0339	MAX+9.5e XP0339 A 3 -0.041 5.019 2 1	MAX+9e XP0339 A 3 -0.04 5.018 2 1

1.4 称重欠载下限 Under load status (exceeds the limits of indication)

$[-20e, 0]$

对应的 SICS 指令：

Command	Example
I61	I61 A -0.040 6.018 kg //标黄对应-20e
XP0339	XP0339 A 3 -0.04 6.018 2 1 //标黄对应-20e

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI
XP0339	-20.5e XP0339 A 3 -0.041 6.019 2 1	-20e XP0339 A 3 -0.04 6.018 2 1

1.5 扩展显示 x10 Extended indicating device

Scale 或仪表上通常有扩展显示。

如 FreshWay 秤上有显示高精度，会扩展一位(x10)显示。但 FreshWay 有点特殊，虽然 SIX2 显示为扩展 2 位，但 SST 工具上只会显示扩展 1 位。

对应的 SICS 指令：

Command	Example
---------	---------

SIX2	SIX2 S 1 N N C 0 0 0 1 N 0.026 0.026 0.000 S 0.02568 kg //标黄对应扩展显示
XM1028	XM1028 A 100.0 //标黄若为 100，则表示扩展 2 位；10 表示扩展 1 位

1.6 开机清零 Initial zero

有一个配置与开机零点往下偏移有关，即 XP0955 命令。根据 OIML 要求，如果 XP0337 超过 4%，则不能偏移开机零点，即 XP0955 必须设为 1。

XP0955 – Initial Zero Behavior
XP0955 – Initial Zero Behavior

Description
This command defines the behavior of the initial zero setting. It defines if the point of initial zero might be shifted down when a zero is captured below the initial zero point, or if the initial zero point is fixed.
The range where initial zero might be shifted is defined with XP0337 (switch on range).
The command is necessary to be compatible with the different weighing standards such as OIML R 76-1 [19] or NTEP/NIST Handbook 44 [20]. The OIML R 76-1 [19] regulation limits the maximum effect of zero setting to 4% of maximum capacity. This limitation cannot be fulfilled when the initial zero point can be shifted downwards until the lower limit of XP0337.

Syntax

Reads the parameters from the device.

Command XP0955
Response XP0955 A Mode

Writes the parameters to the device.

Command XP0955 Mode
Response XP0955 A

Parameters

Mode	Identification for the mode of initial zero behavior {Data type: unsigned 16 bits; range of values see below.}						
	<table><tr><th>Mode</th><th>Initial zero behavior</th></tr><tr><td>0</td><td>Initial zero point might be shifted down by zero setting</td></tr><tr><td>1</td><td>Initial zero point is fixed to the value taken at startup</td></tr></table>	Mode	Initial zero behavior	0	Initial zero point might be shifted down by zero setting	1	Initial zero point is fixed to the value taken at startup
Mode	Initial zero behavior						
0	Initial zero point might be shifted down by zero setting						
1	Initial zero point is fixed to the value taken at startup						

范围: [-2%, 18%] MAX， 相对于生产零点。
以 MAX 为 6kg 为例， 范围为[-0.12kg, 1.08kg]
对应的 SICS 指令：

Command	Example
I47	I47 A -0.120 1.080 kg
I48	I48 A -0.120 1.080 kg
XP0337	XP0337 A -0.12 1.08
XP0315	XP0315 A -0.12 1.08

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI
XP0337, XP0315	[-2%-0.5e, 18%+0.5e] XP0337 A -0.121 1.501	[-2%, 18%] XP0337 A -0.12 1.08

	XP0315 A -0.121 1.501	XP0315 A -0.12 1.08
--	-----------------------	---------------------

1.7 半自动置零 Semi-automatic zero

范围：
≤4% Max(OIML)
初始置零、置零总效果不超过 20%(NTEP)

XP0397 – Zero Behavior

XP0397 – Zero Behavior

Description

This command defines the behavior of the zero commands. The command is necessary to be compatible with the different weighing standards such as *OIML R 76-1* [19] or *NTEP/NIST Handbook 44* [20]. The *OIML R 76-1* [19] regulations require a taring action when a zeroing action is performed. The *NTEP/NIST Handbook 44* [20] regulations do not allow taring when a zero operation is done.

Syntax

Reads the parameters from the device.

Command	XP0397
Response	XP0397 A Mode

Writes the parameters to the device.

Command	XP0397 Mode
Response	XP0397 A

Parameters

Mode	Identification for the mode defines how the zero commands behave. {Data type: boolean}
Value	Meaning
0	Zero command updates zero and tare register according to <i>OIML R 76-1</i> [19]
1	Zero command updates zero register but not the tare register according to <i>NTEP/NIST Handbook 44</i> [20]

以 MAX 为 6kg 为例，范围为[-0.12kg, 0.12kg]
对应的 SICS 指令：

Command	Example
I49	I49 A -0.120 0.120 kg
XP0370	XP0370 A -0.12 0.12

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI
XP0370	[-2%-0.5e, 2%+0.5e] XP0370 A -0.121 0.121	[-2%, 2%] XP0370 A -0.12 0.12

1.8 零点跟踪 Zero-tracking

至少满足以下条件：

相对于生产零点：[max(开机清零下限，半自动置零下限), min(开机清零上限，半自动置零上限)]。通常为[-2%, 2%]MAX。以 MAX 为 6kg 为例，范围为[-0.12kg, 0.12kg]。

相对于当前零点：若 OIML, 则为 $\leq 0.5d$ ；若为 NTEP, 则为 $\leq 3d$ 或 $0.5d$

以 d 为 2g 为例，范围为 OIML: $\leq 1g$, NTEP: $\leq 6g$ 或 $1g$

对应的 SICS 指令：

Command	Example
I52	I52 A 1
M03	M03 A 1 //该值必须与 XP0330 保持一致
XM1034	XM1034 A 0.3 0.5 1 //标黄为 0.5d
XP0330	XP0330 A 0.3 0.5 1 //标黄为 0.5d

1.9 按键除皮 Tare

范围

$\leq \text{Max}$

不同业务部门的特殊要求：

- 商衡只允许累加皮重，不允许累减皮重即皮重值不允许减小。即 XP0916 设为 1。并且 Fresh 产品有如下要求：
 - When PresetTare is active, Tare is possible only if Tare \geq PresetTare.
 - Pretare can be cleared at any time.
 - Preset tare should not be possible if Tare is active.
- BUSI 允许减少皮重，即 XP0916 设为 0。并且：
 - 有预置皮重时也可以执行皮重（Tare）进行增减皮重
 - 有皮重（Tare）时也可以执行预置皮重进行增减皮重

XP0398 - Tare behavior:

XP0398 – Tare behavior**Description**

This command defines the behavior of the tare commands. The command is necessary to be compatible with the different weighing standards such as *OIML R 76-1* [19] or *NTEP/NIST Handbook 44* [20]. If the gross weight is within a $\frac{1}{2}$ d around gross zero the *OIML R 76-1* [19] regulations allow a zero action when a tare action is performed. The *NTEP/NIST Handbook 44* [20] regulations do not allow zeroing when a tare operation is done. If the gross weight is smaller than $-\frac{1}{2}$ d or within a $\frac{1}{2}$ d around gross zero and we have a not approved system, the tare register is cleared and a zero action is performed for customer convenience.

	Gross weight within $\frac{1}{2}$ d around gross zero	Gross weight smaller than $-\frac{1}{2}$ d with respect to gross zero	Gross greater than $\frac{1}{2}$ d with respect to gross zero
<i>OIML R 76-1</i> [19]	Clear Tare Set Zero	Reject tare operation	Tare
<i>NTEP/NIST Handbook 44</i> [20]	Clear Tare	Reject tare operation	Tare
Not approved	Clear Tare Set Zero	Clear Tare Set Zero	Tare

It is also possible to have the tare command execute a tare or zero depending on the zero range setting (M82). This is used for balances with a combined zero/tare key.

	Gross weight smaller or equal to zero range setting (M82) with respect to gross zero	Gross greater than zero range setting (M82) with respect to gross zero
According to zero range	Clear Tare Set Zero	Tare

Command XP0398 Mode
Response XP0398 A

Parameters

Mode Identification for the mode defines how the tare commands behave.
{Data type: unsigned 8 bits; range of values see below.}

Value	Meaning
0	Tare commands update tare and zero register; <i>OIML R 76-1</i> [19]
1	Tare commands update tare register but not zero register; <i>NTEP/NIST Handbook 44</i> [20]
2	Tare commands clear tare register and update the zero register. Only needed for not approved systems.
3	Tare command updates tare and zero register according to zero range settings (M82)

XP0916 – Tare Reduction Mode

XP0916 – Tare Reduction Mode

Description
The setting of this command decides if a smaller tare or pretare value can be captured when already a tare or pretare value is present. If it is not allowed to set a smaller tare or pretare value, the tare or pretare value can only be cancelled when no load is present on the weighing pan (gross = 0). When pretare is associated with price look up (PLU), mode 2 has to be selected which allows canceling and change of pretare at any time. For more details, see OIML R 76-1 [19, paragraph 4.13.3.2 and 4.13.4] and NTEP/NIST Handbook 44 [20, paragraph S.2.3].

Syntax

Reads the parameters from the device.

Command XP0916
Response XP0916 A Mode

Writes the parameters to the device.

Command XP0916 Mode
Response XP0916 A

Parameters

Mode	Identification for tare reduction mode {Data type: unsigned 8 bits; range of values: 0 ... 3}
Value	Meaning
0	Tare and pretare can be increased, reduced and cleared at any time.
1	Tare and pretare can only be increased, clearing of tare and pretare is only possible when no load is on the load receptor.
2	Tare can only be increased, clearing of tare is only possible when no load is on the load receptor. Pretare can be set at any time. This mode must be used when pretare is associated with PLU.
3	Pretare is not allowed. Repeated tare function without executing a zero first is not allowed. This means no chain tare; the tare register can only be set to zero or set to a value if it is already zero.

如下指令在不同业务部门的要求不一样：

Command	Retail	BUSI (ASM)
I39	I39 A 0.000 6.000 kg	I39 A -0.002 6.000 kg
XP0901	[-0.5e, MAX+0.5e] XP0901 A -0.001 6.001	[-0.5e, MAX+0.49e] XP0901 A -0.001 6.00098

1.10 预制皮重 Preset tare

范围：
Single-interval: ≤Max
Multi-interval: ≤Max1
Multi-range: ≤Max
使用限制参见 Tare 中的 XP0916 - Tare Reduction Mode

对应的 SICS 指令：

Command	Example
I40	I40 A 0.000 6.000 kg
XP0902	XP0902 A 0.0 6.0

1.11 按键清皮 Clear tare

范围：

Approved: [-0.5d, 0.5d]

Not approved: $\leq 0.5d$

使用限制参见 Tare 中的 XP0916 - Tare Reduction Mode

对应的 SICS 指令：

Command	Example
TAC	TAC A

1.12 自动除皮 Automatic tare

范围：

$\leq \text{Max}$

对应的 SICS 指令：

Command	Example
M60	M60 A 1
M61	M61 A 150 g 150 g 1 1

1.13 自动清皮 Automatic clear tare

范围：

$\leq \text{Max}$

对应的 SICS 指令：

Command	Example
M62	M62 A 1
M63	M63 A 50 g 1

1.14 零点光标 Zero indicating

范围：

$\leq \pm 0.25e$

对应的 SICS 指令：

Command	Example
SIX2	SIX2 S 1 Z N C 0 0 0 1 N 0.000 0.000 0.000 S 0.0000 kg //标黄部分为零光标

1.15 显示皮重 Tare weight shows

对应的 SICS 指令：

Command	Example
SIX1	SIX1 S 1 N N C 0 0 0 1 M 0.020 0.000 0.020 kg //标黄部分为 Tare

1.16 显示毛重、净重 Gross NET shows

毛重计算方式跟 XP0907 配置有关。BUSI 和 Retail 都设置 XP0907 为 1。

XP0907 – Gross Calculation Setting

XP0907 – Gross Calculation Setting

Description
This command defines how the gross value is calculated for the S commands that return consistent weight values of gross, net and tare values.

Syntax

Reads the parameters from the device.

Command XP0907
Response XP0907 A Calc

Writes the parameters to the device.

Command XP0907 Calc
Response XP0907 A

Parameters	
Calc	Identification for type of the calculation {Data type: unsigned 8 bits; range of values see below.}
Value	Meaning
0	Net, tare and gross values are rounded separately.
1	Gross is calculated based on rounded net and rounded tare values.
2	Gross is calculated based on rounded net and rounded tare values tare is rounded in net range – gross, net and tare values are displayed in net range

对应的 SICS 指令：

Command	Example
SIX1	SIX1 S 1 N N C 0 0 0 1 M 0.050 0.030 0.020 kg //标绿为 Gross，标黄为 NET

1.17 欠载符号 The indicating of under load

显示欠载的条件包括如下：

- 1) 不能低于 1.4 称重欠载下限
- 2) 不能低于相对于生产零点的开机清零范围下限（1.6 开机清零）

对应的 SICS 指令：

Command	Example
---------	---------

SIX1	SIX1 - //标黄部分为欠载
------	-----------------------------------------------------------------

1.18 过载符号 The indicating of over load

对应的 SICS 指令：

Command	Example
SIX1	SIX1 + //标黄部分为过载

1.19 零点标定 Zero calibration

跟标定相关有一个允差设置

XP0325 – Calibration and Adjustment Tolerances

XP0325 – Calibration and Adjustment Tolerances

Description

Tolerances for calibration/adjustment load during the calibration or adjustment is running.

Syntax

Reads the parameters from the device.

```
Command      XP0325
Response     XP0325 A Tolerance Delta
```

Writes the parameters to the device.

```
Command      XP0325 Tolerance Delta
Response     XP0325 A
```

Parameters

Tolerance Tolerance in $\frac{0}{100}$ (per mille) of the calibration/adjustment load
{Data type: unsigned 16 bits}

Delta Deviation between the zero loads in digits. (For a definition of a digit, please refer chapter **Glossary** in *Engineering Internal MT-SICS General Manual* [10].
{Data type: unsigned 16 bits}

零点标定包括：

- 1) Factory Zero Adjustment. XP0625 1
- 2) Customer Zero Adjustment. XP0629 1
- 3) Scale Production Zero Adjustment. XP0634 2

对应的 SICS 指令：

Command	Example
XP0625	XP0625 1 XP0625 B XP0625 C 0 R o "0" " 0.000 kg" XP0625 C

	XP0625 B 0 D o "0" "	0.000 kg"
	XP0625 A	
XP0629	XP0629 1 XP0629 B XP0629 C 0 R o "0" "	0.000 kg"
	XP0629 C XP0629 B 0 D o "0" "	0.000 kg"
	XP0629 A	
XP0634	XP0634 2 XP0634 B XP0634 C 0 R o "0" "	0.000 kg"
	XP0634 C XP0634 B 0 D o "0" "	0.000 kg"
	XP0634 A	

1.20 两点标定 2 points calibration (zero & span)

跟标定相关有一个允差设置 XP0325，参见 Zero Calibration。

另外，还有下面一个允差设置 XP0935。

XP0935 – Customer Standard Adjustment Tolerances

XP0935 – Customer Standard Adjustment Tolerances

Description

The customer standard adjustment has a stricter tolerance than the external adjustment. This command defines this tolerance in relation to the factory standard adjustment.

Syntax

Reads the parameters from the device.

```
Command      XP0935
Response     XP0935 A Tolerance
```

Writes the parameters to the device.

```
Command      XP0935 Tolerance
Response     XP0935 A
```

Parameters

```
Tolerance    Tolerance in %% of the factory standard cal value
              {Data type: float 32 bits}
```

两点标定包括：

1) Factory Calibration Adjustment. XP0624 2 {标定重量}

2) Customer Calibration Adjustment.

XP0628 2 {标定重量}

C1, C2 (precondition: using M19 set {标定重量})

3) Scale Production Calibration. XP0633 2 {标定重量}

注：{标定重量}有范围要求，通常为容量的 10% ~ 100%。如果{标定重量}不在此范围内，会返回 E 4 或 I。

对应的 SICS 指令：

Command	Example
XP0624	XP0624 2 6 //标定6kg，单位与XP0317保持一致 XP0624 B XP0624 C 0 R o "0" " 0.000 kg" ZZ41 2 0 //模拟加载0kg ZZ41 A XP0624 C XP0624 B 0 D o "0" " 0.000 kg" XP0624 C 1 R - "1" " 6.000 kg" ZZ41 2 6000 //模拟加载6kg XP0624 C 1 R o "1" " 6.000 kg" ZZ41 A XP0624 C XP0624 B 1 D o "1" " " XP0624 C 2 R + "0" " 0.000 kg" ZZ41 2 0 //模拟加载为0kg ZZ41 A XP0624 C 2 R o "0" " 0.000 kg" XP0624 C XP0624 B 2 D o "0" " " XP0624 B 2 C o "0" "0.00" XP0624 A
XP0628	XP0628 2 6.0 XP0628 B XP0628 C 0 R o "0" " 0.000 kg" ZZ41 2 0 ZZ41 A XP0628 C XP0628 B 0 D o "0" " 0.000 kg" XP0628 C 1 R - "1" " 6.000 kg" ZZ41 2 6000 XP0628 C 1 R o "1" " 6.000 kg" ZZ41 A XP0628 C XP0628 B 1 D o "1" " " XP0628 C 2 R + "0" " 0.000 kg" ZZ41 2 0 ZZ41 A

	XP0628 C 2 R o "0" " 0.000 kg" XP0628 C XP0628 B 2 D o "0" " XP0628 B 2 C o "0" "0.00" XP0628 A
C1, C2	M19 80000 g M19 A C0 C0 A 0 1 " 80000.0 g" C1 C1 B C1 " 0.0 g" C1 " 80000.0 g" ZZ41 1 80000 ZZ41 A C1 " 0.0 g" ZZ41 1 0 ZZ41 A C1 A C2 C2 B C2 " 0.0 g" C2 " 80000.0 g" ZZ41 1 80000 ZZ41 A C2 " 0.0 g" ZZ41 1 0 ZZ41 A C2 A
XP0633	XP0633 2 6.0 XP0633 B XP0633 C 0 R o "0" " 0.000 kg" ZZ41 2 0 ZZ41 A XP0633 C XP0633 B 0 D o "0" " 0.000 kg" XP0633 C 1 R - "1" " 6.000 kg" ZZ41 2 6000 XP0633 C 1 R o "1" " 6.000 kg" ZZ41 A XP0633 C XP0633 B 1 D o "1" " XP0633 C 2 R + "0" " 0.000 kg" ZZ41 2 0

	ZZ41 A XP0633 C 2 R o "0" " 0.000 kg" XP0633 C XP0633 B 2 D o "0" " " XP0633 B 2 C o "0" "0.00" XP0633 A
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1.21 线性标定 Linearity calibration (3-point, 4-point, 5-point etc.)

跟标定相关有一个允差设置 XP0325，参见 Zero Calibration。

另外还有一个允差设置 XP0935，参见 2 points calibration。

线性标定包括：

1) Factory Linearization Adjustment.

XP0622 2 {标定重量} //三点标定

XP0622 4 {标定重量} //五点标定

2) Customer Linearization Adjustment.

XP0626 2 {标定重量} //三点标定

XP0626 7 {标定重量} //五点标定

C6 2 (precondition: using M19 set {标定重量}) //三点标定

C6 7 (precondition: using M19 set {标定重量}) //五点标定

3) Scale Production Linearization.

XP0632 2 {标定重量} //三点标定

XP0632 5 {标定重量} //五点标定

注：{标定重量}有范围要求，通常为容量的 10% ~ 100%。如果{标定重量}不在此范围内，会返回 E 4 或 I。

对应的 SICS 指令：

Command	Example
XP0622	XP0622 2 6 //三点标定 XP0622 B XP0622 C 0 R o "0+0" " 0.000 kg" ZZ41 2 0 ZZ41 A XP0622 C XP0622 B 0 D o "0+0" " 0.000 kg" XP0622 C 1 R - "1+2" " 6.000 kg" ZZ41 2 6000 XP0622 C 1 R o "1+2" " 6.000 kg" ZZ41 A XP0622 C

XP0622 B 1 D o "1+2" "	"
XP0622 C 2 R + "0+0" "	0.000 kg"
ZZ41 2 0	
XP0622 C 2 R o "0+0" "	0.000 kg"
ZZ41 A	
XP0622 C	
XP0622 B 2 D o "0+0" "	"
XP0622 C 3 R - "1+0" "	3.000 kg"
ZZ41 2 3000	
XP0622 C 3 R o "1+0" "	3.000 kg"
ZZ41 A	
XP0622 C	
XP0622 B 3 D o "1+0" "	"
XP0622 C 4 R - "1+2" "	6.000 kg"
ZZ41 2 6000	
XP0622 C 4 R o "1+2" "	6.000 kg"
ZZ41 A	
XP0622 C	
XP0622 B 4 D o "1+2" "	"
XP0622 C 5 R + "0+2" "	3.000 kg"
ZZ41 2 3000	
XP0622 C 5 R o "0+2" "	3.000 kg"
ZZ41 A	
XP0622 C	
XP0622 B 5 D o "0+2" "	"
XP0622 C 6 R + "0+0" "	0.000 kg"
ZZ41 2 0	
XP0622 C 6 R o "0+0" "	0.000 kg"
ZZ41 A	
XP0622 C	
XP0622 B 6 D o "0+0" "	"
XP0622 B 6 C o "0+0" "0.00"	
XP0622 A	
XP0622 4 6.0 // 五点标定	
XP0622 B	
XP0622 C 0 R o "0+0+0+0" "	0.000 kg"
ZZ41 2 0	
ZZ41 A	
XP0622 C	
XP0622 B 0 D o "0+0+0+0" "	0.000 kg"
XP0622 C 1 R - "1+2+3+4" "	6.000 kg"
ZZ41 2 6000	
XP0622 C 1 R o "1+2+3+4" "	6.000 kg"

	ZZ41 A	
	XP0622 C	
	XP0622 B 1 D o "1+2+3+4" "	"
	XP0622 C 2 R + "0+0+0+0" "	0.000 kg"
	ZZ41 2 0	
	XP0622 C 2 R o "0+0+0+0" "	0.000 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 2 D o "0+0+0+0" "	"
	XP0622 C 3 R - "1+0+0+0" "	1.500 kg"
	ZZ41 2 1500	
	XP0622 C 3 R o "1+0+0+0" "	1.500 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 3 D o "1+0+0+0" "	"
	XP0622 C 4 R - "1+2+0+0" "	3.000 kg"
	ZZ41 2 3000	
	XP0622 C 4 R o "1+2+0+0" "	3.000 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 4 D o "1+2+0+0" "	"
	XP0622 C 5 R - "1+2+3+0" "	4.500 kg"
	ZZ41 2 4500	
	XP0622 C 5 R o "1+2+3+0" "	4.500 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 5 D o "1+2+3+0" "	"
	XP0622 C 6 R - "1+2+3+4" "	6.000 kg"
	ZZ41 2 6000	
	XP0622 C 6 R o "1+2+3+4" "	6.000 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 6 D o "1+2+3+4" "	"
	XP0622 C 7 R + "0+2+3+4" "	4.500 kg"
	ZZ41 2 4500	
	XP0622 C 7 R o "0+2+3+4" "	4.500 kg"
	ZZ41 A	
	XP0622 C	
	XP0622 B 7 D o "0+2+3+4" "	"
	XP0622 C 8 R + "0+2+3+0" "	3.000 kg"
	ZZ41 2 3000	
	XP0622 C 8 R o "0+2+3+0" "	3.000 kg"
	ZZ41 A	
	XP0622 C	

	XP0622 B 8 D o "0+2+3+0" " " XP0622 C 9 R + "0+2+0+0" " 1.500 kg" ZZ41 2 1500 XP0622 C 9 R o "0+2+0+0" " 1.500 kg" ZZ41 A XP0622 C XP0622 B 9 D o "0+2+0+0" " " XP0622 C 10 R + "0+0+0+0" " 0.000 kg" ZZ41 2 0 XP0622 C 10 R o "0+0+0+0" " 0.000 kg" ZZ41 A XP0622 C XP0622 B 10 D o "0+0+0+0" " " XP0622 B 10 C o "0+0+0+0" "0.00" XP0622 A
XP0626	XP0626 2 6.0 // 三点标定 XP0626 B XP0626 C 0 R o "0+0" " 0.000 kg" ZZ41 2 0 ZZ41 A XP0626 C XP0626 B 0 D o "0+0" " 0.000 kg" XP0626 C 1 R - "1+0" " 3.000 kg" ZZ41 2 3000 XP0626 C 1 R o "1+0" " 3.000 kg" ZZ41 A XP0626 C XP0626 B 1 D o "1+0" " " XP0626 C 2 R - "1+2" " 6.000 kg" ZZ41 2 6000 XP0626 C 2 R o "1+2" " 6.000 kg" ZZ41 A XP0626 C XP0626 B 2 D o "1+2" " " XP0626 B 2 C o "1+2" "0.00" XP0626 A XP0626 7 6.0 // 五点标定 XP0626 B XP0626 C 0 R o "0+0+0+0" " 0.000 kg" ZZ41 2 0 ZZ41 A XP0626 C XP0626 B 0 D o "0+0+0+0" " 0.000 kg"

	XP0626 C 1 R - "1+0+0+0" " 1.500 kg" ZZ41 2 1500 XP0626 C 1 R o "1+0+0+0" " 1.500 kg" ZZ41 A XP0626 C XP0626 B 1 D o "1+0+0+0" " " XP0626 C 2 R - "1+2+0+0" " 3.000 kg" ZZ41 2 3000 XP0626 C 2 R o "1+2+0+0" " 3.000 kg" ZZ41 A XP0626 C XP0626 B 2 D o "1+2+0+0" " " XP0626 C 3 R - "1+2+3+0" " 4.500 kg" ZZ41 2 4500 XP0626 C 3 R o "1+2+3+0" " 4.500 kg" ZZ41 A XP0626 C XP0626 B 3 D o "1+2+3+0" " " XP0626 C 4 R - "1+2+3+4" " 6.000 kg" ZZ41 2 6000 XP0626 C 4 R o "1+2+3+4" " 6.000 kg" ZZ41 A XP0626 C XP0626 B 4 D o "1+2+3+4" " " XP0626 B 4 C o "1+2+3+4" "0.00" XP0626 A
C6	M19 80000 g M19 A C5 0 C5 A C6 2 // 三点标定 C6 B C6 B 0 D o "0+0" " 0.0 g" C6 B 1 R - "1+0" " 40000.0 g" ZZ41 1 40000 C6 B 1 D o "1+0" " " ZZ41 A C6 B 2 R - "1+2" " 80000.0 g" ZZ41 2 80000 C6 B 2 D o "1+2" " " ZZ41 A C6 B 2 C o "1+2" "0.000" C6 A

	<p>C6 7 // 五点标定</p> <p>C6 B</p> <p>C6 B 0 R + "0+0+0+0" " 0.0 g"</p> <p>ZZ41 1 0</p> <p>C6 B 0 D o "0+0+0+0" " 0.0 g"</p> <p>ZZ41 A</p> <p>C6 B 1 R - "1+0+0+0" " 20000.0 g"</p> <p>ZZ41 1 20000</p> <p>C6 B 1 D o "1+0+0+0" " "</p> <p>ZZ41 A</p> <p>C6 B 2 R - "1+2+0+0" " 40000.0 g"</p> <p>ZZ41 1 40000</p> <p>C6 B 2 D o "1+2+0+0" " "</p> <p>ZZ41 A</p> <p>C6 B 3 R - "1+2+3+0" " 60000.0 g"</p> <p>ZZ41 1 60000</p> <p>C6 B 3 D o "1+2+3+0" " "</p> <p>ZZ41 A</p> <p>C6 B 4 R - "1+2+3+4" " 80000.0 g"</p> <p>ZZ41 1 80000</p> <p>C6 B 4 D o "1+2+3+4" " "</p> <p>ZZ41 A</p> <p>C6 B 4 C o "1+2+3+4" "0.000"</p> <p>C6 A</p>
XP0632	<p>XP0632 2 6.0 // 三点标定</p> <p>XP0632 B</p> <p>XP0632 C 0 R o "0+0" " 0.000 kg"</p> <p>ZZ41 2 0</p> <p>ZZ41 A</p> <p>XP0632 C</p> <p>XP0632 B 0 D o "0+0" " 0.000 kg"</p> <p>XP0632 C 1 R - "1+2" " 6.000 kg"</p> <p>ZZ41 2 6000</p> <p>XP0632 C 1 R o "1+2" " 6.000 kg"</p> <p>ZZ41 A</p> <p>XP0632 C</p> <p>XP0632 B 1 D o "1+2" " "</p> <p>XP0632 C 2 R + "0+0" " 0.000 kg"</p> <p>ZZ41 2 0</p> <p>XP0632 C 2 R o "0+0" " 0.000 kg"</p> <p>ZZ41 A</p> <p>XP0632 C</p> <p>XP0632 B 2 D o "0+0" " "</p> <p>XP0632 C 3 R - "1+0" " 3.000 kg"</p>

ZZ41 2 3000	
XP0632 C 3 R o "1+0" "	3.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 3 D o "1+0" "	"
XP0632 C 4 R - "1+2" "	6.000 kg"
ZZ41 2 6000	
XP0632 C 4 R o "1+2" "	6.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 4 D o "1+2" "	"
XP0632 C 5 R + "0+2" "	3.000 kg"
ZZ41 2 3000	
XP0632 C 5 R o "0+2" "	3.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 5 D o "0+2" "	"
XP0632 C 6 R + "0+0" "	0.000 kg"
ZZ41 2 0	
XP0632 C 6 R o "0+0" "	0.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 6 D o "0+0" "	"
XP0632 B 6 C o "0+0" "0.00"	
XP0632 A	
XP0632 5 6.0 // 五点标定	
XP0632 B	
XP0632 C 0 R o "0+0+0+0" "	0.000 kg"
ZZ41 2 0	
ZZ41 A	
XP0632 C	
XP0632 B 0 D o "0+0+0+0" "	0.000 kg"
XP0632 C 1 R - "1+2+3+4" "	6.000 kg"
ZZ41 2 6000	
XP0632 C 1 R o "1+2+3+4" "	6.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 1 D o "1+2+3+4" "	"
XP0632 C 2 R + "0+0+0+0" "	0.000 kg"
ZZ41 2 0	
XP0632 C 2 R o "0+0+0+0" "	0.000 kg"
ZZ41 A	
XP0632 C	

XP0632 B 2 D o "0+0+0+0" "	"
XP0632 C 3 R - "1+0+0+0" "	1.500 kg"
ZZ41 2 1500	
XP0632 C 3 R o "1+0+0+0" "	1.500 kg"
ZZ41 A	
XP0632 C	
XP0632 B 3 D o "1+0+0+0" "	"
XP0632 C 4 R - "1+2+0+0" "	3.000 kg"
ZZ41 2 3000	
XP0632 C 4 R o "1+2+0+0" "	3.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 4 D o "1+2+0+0" "	"
XP0632 C 5 R - "1+2+3+0" "	4.500 kg"
ZZ41 2 4500	
XP0632 C 5 R o "1+2+3+0" "	4.500 kg"
ZZ41 A	
XP0632 C	
XP0632 B 5 D o "1+2+3+0" "	"
XP0632 C 6 R - "1+2+3+4" "	6.000 kg"
ZZ41 2 6000	
XP0632 C 6 R o "1+2+3+4" "	6.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 6 D o "1+2+3+4" "	"
XP0632 C 7 R + "0+2+3+4" "	4.500 kg"
ZZ41 2 4500	
XP0632 C 7 R o "0+2+3+4" "	4.500 kg"
ZZ41 A	
XP0632 C	
XP0632 B 7 D o "0+2+3+4" "	"
XP0632 C 8 R + "0+2+3+0" "	3.000 kg"
ZZ41 2 3000	
XP0632 C 8 R o "0+2+3+0" "	3.000 kg"
ZZ41 A	
XP0632 C	
XP0632 B 8 D o "0+2+3+0" "	"
XP0632 C 9 R + "0+2+0+0" "	1.500 kg"
ZZ41 2 1500	
XP0632 C 9 R o "0+2+0+0" "	1.500 kg"
ZZ41 A	
XP0632 C	
XP0632 B 9 D o "0+2+0+0" "	"
XP0632 C 10 R + "0+0+0+0" "	0.000 kg"

	<div>ZZ41 2 0</div> <div>XP0632 C 10 R o "0+0+0+0" "0.000 kg"</div> <div>ZZ41 A</div> <div>XP0632 C</div> <div>XP0632 B 10 D o "0+0+0+0" "</div> <div>XP0632 B 10 C o "0+0+0+0" "0.00"</div> <div>XP0632 A</div>
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1.22 GEO Gravity compensation

对应的 SICS 指令：

Command	Example
XP0377	XP0377 A 12
XP0390	XP0390 A -1
XP0947	XP0947 A 12.0
XP0948	XP0948 A -1.0
I41	I41 A 12
I42	I42 A -1
I74	I74 A 12.0
I75	I75 A -1.0

1.23 单位切换 Units switch

传感器内部基准单位以 XP0317 为准。
重量数据显示时（如 SI）的单位以 M21 为准。
XP0317 和 M21 是相互独立的。如 XP0317 定义单位为 g，M21 可以定义单位为 kg，最终重量数据显示时以 M21 为准。

对应的 SICS 指令：

Command	Example
M21	<div>M21 B 0 1 // Host Unit</div> <div>M21 B 1 1</div> <div>M21 A 2 1</div>
XP0317	XP0317 A 1

1.24 示值的形式 Form of the indication

常用重量示值的命令是 SIX2，格式如下，具体字段含义参见 SICS 文档。
SIX2 Sts MinW CoZ Rep Calc PosE StepE Marke Range TM G N T HrSts HR Unit
有如下注意点：

- **MinW** 标记显示与净重 **N** 和当前 **Range** 的最小容量（章节 1.2）有关。规则如下：
若净重 **N** 大于等于当前 **Range** 的最小容量，则 **MinW** 显示 2；否则显示 1。
- **Range** 标记显示规则如下：

Single range:	1	
Multi range:	1, 2, ..., n	Range is linked to gross value
Multi interval:	1, 2, ..., n	Range is linked to net value

对应的 SICS 指令：

Command	Example		
SIX2	SIX2 S 1 N N C 0 0 0 1 N	0.026	0.026
	0.000 S 0.02568 kg		
	SIX2 S 2 N N C 1 5 0 2 P	6.010	5.910
	0.100 S 5.91200 kg		

1.25 示值的变化 Change of indication

改变载荷后，原示值的保持时间应不大于 1s.

对应的 SICS 指令：

Command	Example		
SIX2	SIX2 S 1 N N C 0 0 0 1 N	0.026	0.026
	0.000 S 0.02568 kg		

1.26 法治软件保护 Legally relevant software protection

法治软件保护通常对应如下：

- 1) 工作模式为用户模式，即 XM1008 0
- 2) XP0335 设为不等于 0，通常为 1，代表 Certified device e = 1 d
- 3) XP0610 设为 1，代表 Approved Mode Activated
- 4) XP0903 设置 Approval Type，如 2 代表 OIML R76-1，4 代表 NTEP/NIST Handbook 44。

对应的 SICS 指令：

Command	Example
XM1008	XM1008 A 0
XP0335	XP0335 A 1
XP0610	XP0610 A 1
XP0903	XP0903 A 2
XP0323	XP0323 A 28
I33	I33 A 28
I36	I36 A 2

I72	I72 A 94D38EF1
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1.27 多分度衡器 Multi-interval instrument

XP0373 – Range Switching Behavior with Multi-Use Balances

XP0373 – Range Switching Behavior with Multi-Use Balances

Description

The range switching behavior defines how and if the scale switches from coarser to finer ranges.

Syntax

Reads the parameters from the device.

Command

XP0373

Response

XP0373 A Behavior

Writes the parameters to the device.

Command

XP0373 Behavior

Response

XP0373 A

Parameters

Behavior

Identification for range switching behavior.
{Data type: unsigned 16 bits; range of values see below.}

Value	Meaning
0	Multi-Interval (including Dual Interval Industry and DeltaRange® Laboratory) behavior. Range switching is done from finer to coarser range and the other way round. Stability does not matter.
1	Multiple Range (including Dual Range Industry) behavior. Range switching is done from finer to coarser range. The switching to the finest range is done automatically but only when: <div>- the gross value is within 0.5e (of finest range) around zero</div> <div>- no tare is active</div> <div>- the weight value is stable</div>
2	Special Multiple Range (including Dual Range Laboratory) behavior. Range switching is done from finer to coarser range. Range switching from coarser to finer range is done when no tare value is active. If there is a tare value active, the range switching is done from coarser to finer range until the range is reached where the tare value is within. Stability does not matter.

对应的 SICS 指令:

Command	Example				
XP0339	XP0339 A 3 -0.02 15.045 5 1				
XP0338	XP0338 B 1 5.99899 2 0 XP0338 A 2 2.99949 1 0				
I37	I37 A 3				
I38	I38 B 1	0.020	3.000	0.001	0.001 3
	kg				
	I38 B 2	0.020	6.000	0.002	0.002 3
kg	I38 A 3	0.020	15.000	0.005	0.005 3
	kg				
注：对多分度衡器，MinWeigh对多个量程都是相同的。					

不管是多分度还是多量程衡器，在对多个量程的范围定义上，不同业务部门的要求不一样。

其中 BUSI 的比较特殊，需要使用 e_i 的小数点基础上再扩展两位的 step 为 1 的特殊值，这里用 k_i 来表示。例如： $e_1=2g$ ，则 k_1 为 0.01g； e_2 为 5g，则 k_2 为 0.01g。

假设有三个量程，分别为 $3kg/(e_1=1g)$ ， $6kg/(e_2=2g)$ ， $15kg/(e_3=5g)$

量程范围	Retail	BUSI
第一量程	[0, 3kg+0.5e1) XP0338 A 2 3.0005 1 0	[0, 3kg-0.5e1-k1) XP0338 A 2 2.99949 1 0
第二量程	[3kg+0.5e1, 6kg+0.5e2) XP0338 B 1 6.001 2 0	[3kg-0.5e1-k1, 6kg-0.5e2-k2) XP0338 B 1 5.99899 2 0
第三量程	[6kg+0.5e2, 15kg+9.5e3) XP0339 A 3 -0.0205 15.0475 5 1	[6kg-0.5e2-k2, 15kg-9e3) XP0339 A 3 -0.02 15.045 5 1

1.28 多量程衡器 Multiple range instrument

目前 Retail 的传感器基本上是多分度，不涉及多量程。

BUSI 的传感器涉及多量程。

多量程在重量示值的形式上（如 SIX2）有一定的特殊性，如下：

- 进入大量程再回到小量程，此时仍算大量程。具体到 SIX2，如下，标黄的部分表示所处的量程和分度值。刚开始处于第 1 量程（2g），接着进入第 2 量程，再回到第 1 量程，结果重量显示仍算第 2 量程。
OIML 15kg/5g, 6kg/2g, 2MR(2 Multi Range)
ZZ40 1 0 0 80
SIX2 S 2 N N C 1 2 0 1 N 0.080 0.080 0.000 S 0.08000
kg
ZZ40 1 0 0 6000
SIX2 S 2 N N C 1 5 0 2 N 6.000 6.000 0.000 S 6.00000
kg
ZZ40 1 0 0 80
SIX2 S 1 N N C 1 5 0 2 N 0.080 0.080 0.000 S 0.08000
kg
- SIX2 中处于第几量程不是根据净重 NET 判断，而是根据毛重 Gross 判断。如下，虽然净重 0.5kg 处于第 1 量程，但因为毛重处于第 2 量程，所以 SIX2 显示第 2 量程。
OIML 15kg/5g, 6kg/2g, 2MR
SIX2 S 2 N N C 1 5 0 2 M 6.500 0.500 6.000 S 0.50000
kg

对应的 SICS 指令：

Command	Example
XP0339	XP0339 A 3 -0.02 15.045 5 1

XP0338	XP0338 B 1 5.99899 2 1 XP0338 A 2 2.99949 1 1				
I37	I37 A 2				
I38	I38 B 1	0.020	3.000	0.001	0.001 3
	kg				
	I38 B 2	0.040	6.000	0.002	0.002 3
	kg				
	I38 A 3	0.100	15.000	0.005	0.005 3
	kg				
注：对多量程衡器，MinWeigh对多个量程是不同的。					