

**Quality Excellence for Suppliers of  
Telecommunications Forum  
(QuEST Forum)**

**TL 9000  
Quality Management System  
Measurements Handbook  
FR Examples**

## 7 FR Examples

### 7.1 Basic Calculations

#### Example 7.1-1

Each month the reporting organization reports the FRU return measures for the month based on all returns received during the month and the field population of units at the end of the prior month. The returns and population numbers are split into three separate groups depending on the age of the units. As an example, suppose during January 2017 there were a total of 355 returns received out of a total population of 186,914 units. Of the 355 returns, 153 were shipped during the month or the prior six months. In other words, 153 of the units were shipped on or after July 1, 2016. Likewise, 163 of the returns were 7 to 18 months old having originally been shipped between July 1, 2015 and June 30, 2016. This leaves 39 units returned out of the long-term population, which are units shipped prior to July 1, 2015. Similarly the total population numbers are split into the three age groups. For purposes of this example, let us set these at 57,288, 99,626, and 30,000 units respectively for the ERI, YRR, and LTR subsets of the population. In tabular form the data for the month is:

	ERI	YRR	LTR	Total
Returns	153	163	39	355
Population	57,288	99,626	30,000	186,914

The resulting calculations for the month are

$$\begin{aligned}
 &\text{Early} && \text{Returns from units shipped Jul-16 through Jan-17} \\
 \text{Return} &= 100 \times 12 \times \frac{\quad}{\quad} \\
 \text{Index} &&& \text{Total shipments for Jul-16 through Dec-16} \\
 &= 100 \times 12 \times \text{FRri/FRsi} \\
 &= 100 \times 12 \times 153/57288 \\
 &= 3.20\%
 \end{aligned}$$

$$\begin{aligned}
 &\text{One-Year} && \text{Returns of units shipped Jul-15 through Jun-16} \\
 \text{Return} &= 100 \times 12 \times \frac{\quad}{\quad} \\
 \text{Rate} &&& \text{Total Shipments for Jul-15 through Jun-16} \\
 &= 100 \times 12 \times \text{FRry/FRsy} \\
 &= 100 \times 12 \times 163/99626 \\
 &= 1.96\%
 \end{aligned}$$



**Table 7.2-2 Example Returns**

		Returns from Shipment Population by Month Received											
Shipment Month	Number Shipped	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017	Oct 2017	Nov 2017	Dec 2017
Jun-15 & before	30000	39	44	42	46	31	35	48	36	46	41	32	30
Jul-15	8253	22	9	11	12	11	10	7	10	8	15	16	5
Aug-15	9243	11	11	14	12	19	15	13	1	16	10	13	21
Sep-15	9261	17	16	17	12	16	16	17	7	16	11	12	17
Oct-15	9721	19	13	21	15	17	11	14	19	16	18	17	13
Nov-15	10131	16	8	15	14	21	28	17	17	19	13	14	20
Dec-15	10140	24	16	17	22	12	19	17	15	24	14	15	14
Jan-16	6263	11	11	7	9	9	9	9	13	6	3	6	3
Feb-16	6436	7	9	8	11	10	8	5	5	3	14	7	9
Mar-16	7244	14	15	12	8	10	15	4	12	7	9	5	12
Apr-16	7275	10	9	14	10	9	8	10	6	12	11	11	10
May-16	7396	6	11	12	11	16	9	13	16	8	13	10	3
Jun-16	8263	6	13	12	16	11	7	9	12	14	13	7	13
Jul-16	8833	14	12	14	12	12	14	14	15	11	10	11	8
Aug-16	8954	16	6	14	17	14	14	11	14	12	12	8	13
Sep-16	9368	20	18	15	18	16	6	12	19	12	6	16	11
Oct-16	9818	39	24	18	7	15	15	17	16	13	6	19	9
Nov-16	9787	36	26	24	23	12	13	6	13	9	9	20	12
Dec-16	10528	23	30	20	22	25	15	15	15	16	12	16	11
Jan-17	10644	5	33	23	25	22	30	18	15	14	19	14	19
Feb-17	11321		1	31	23	27	24	24	11	13	22	11	16
Mar-17	11332			5	27	26	20	29	38	17	14	19	12
Apr-17	11674				2	33	28	26	26	16	19	19	12
May-17	12151					4	27	27	28	31	18	13	24
Jun-17	12460						1	31	26	28	26	22	15
Jul-17	13494							1	35	25	32	35	16
Aug-17	13670								5	33	25	28	21
Sep-17	13933									4	30	23	32
Oct-17	13725										4	34	22
Nov-17	14467											3	36
Dec-17	14905												4
<b>Total Returns Received In Month:</b>		<b>355</b>	<b>335</b>	<b>366</b>	<b>374</b>	<b>398</b>	<b>397</b>	<b>414</b>	<b>445</b>	<b>449</b>	<b>449</b>	<b>476</b>	<b>463</b>

Table 7.2-2 shows shipments for July 2015 through December 2017, plus all shipments prior to July 2015. In addition, it shows returns for January 2017 through December 2017, by month of shipment as determined by shipping records. The highlighted first column of data in Table 7.2-2 shows the month of shipment for the 355 returns received during January 2017. For example, in January 2017, 22 returns were received from the 8253 units shipped in July 2015 and 11 returns were received from the 9243 units shipped in August 2015.

The Early Return Index, ERI, for the month of January 2017, is calculated as follows. The field population is determined by adding the shipment quantities shown on the left side of Table 7.2-2 for the months of July 2016 through December 2016. Therefore the total shipments are

$$FRsi = 8833+8954+9368+9818+9787+10528 = 57,288.$$

The number of returned units is the total returned from July 2016 through January 2017. Therefore

$$FRri = 14+16+20+39+36+23+5 = 153.$$

$$\begin{aligned} \text{Early Return Index} &= 100 \times 12 \times \frac{\text{Returns of units shipped Jul-16 through Jan-17}}{\text{Total Shipments for Jul-16 through Dec-16}} \\ &= 100 \times 12 \times \frac{FRri}{FRsi} \\ &= 100 \times 12 \times \frac{153}{57288} \\ &= 3.20\% \end{aligned}$$

Note that the returns of units shipped in January are included to count all returns during the month and to be alerted to any developing problems. However, shipments during January are excluded because the majority of units shipped in January will not have been placed in operation.

The One-Year Return Rate, YRR, for January 2017, is calculated as follows. The field population is determined by adding the shipment quantities shown on the left side of Table 7.2-2 for the months of July 2015 through June 2016. Therefore the total shipments are

$$FRsy = 8253+9243+9261+9721+10131+10140+6263+6436+7244+7275+7396+8263 = 99626.$$

The number of returned units is the total returned from units shipped in July 2015 through June 2016. Therefore

$$FRry = 22+11+17+19+16+24+11+7+14+10+6+6 = 163.$$

$$\begin{aligned}
 \text{One-Year} & \quad \text{Returns of units shipped Jul-15 through Jun-16} \\
 \text{Return} & = 100 \times 12 \times \frac{\quad}{\quad} \\
 \text{Rate} & \quad \text{Total Shipments for Jul-15 through Jun-16} \\
 & = 100 \times 12 \times \text{FR}_{ry}/\text{FR}_{sy} \\
 & = 100 \times 12 \times 163/99626 \\
 & = 1.96\%
 \end{aligned}$$

The Long Term Return Rate, LTR, for January 2017, is calculated as follows. The field population is determined by summing the shipment quantities shown on the left side of Table 7.2-2 for the months prior to July 2015. Therefore the total shipments are

$$\text{FR}_{st} = 30,000.$$

The number of returned units is the total returned from units shipped prior to July 2015. Therefore

$$\text{FR}_{rt} = 39.$$

$$\begin{aligned}
 \text{Long-Term} & \quad \text{Returns from shipments prior to Jul-15} \\
 \text{Return} & = 100 \times 12 \times \frac{\quad}{\quad} \\
 \text{Rate} & \quad \text{Total Shipments prior to Jul-15} \\
 & = 100 \times 12 \times \text{FR}_{rt}/\text{FR}_{st} \\
 & = 100 \times 12 \times 39/30000 \\
 & = 1.56\%
 \end{aligned}$$

Calculating the return rates for all months in 2017 gives

Month in 2017	Early Return Index	One-Year Return Rate	Long-Term Return Rate
January	3.20%	1.96%	1.56%
February	2.80%	1.72%	1.66%
March	2.66%	1.96%	1.69%
April	2.44%	1.96%	1.73%
May	2.74%	1.86%	1.70%
June	2.57%	1.65%	1.80%
July	2.69%	1.50%	1.84%
August	2.80%	1.81%	1.52%
September	2.47%	1.55%	1.86%
October	2.39%	1.55%	1.66%
November	2.39%	1.73%	1.56%
December	2.14%	1.57%	1.55%

## 2) Field Replaceable Unit (FRU) Returns Data Table

The data reported to the TL 9000 Administrator are shown in Table 7.2-3.

**Table 7.2-3 Example 1 – FR Data Table Report**

<b>Identifier</b>	<b>Value</b>
Year	2017
Month	01
Product Category	1.1
MeasurementID	FR
FRa	12
FRs	99626
FRri	153
FRry	163
FRrt	39
FRsi	57288
FRsy	99626
FRst	30000

### 7.3 Accounting for Decommissioned Units

As noted in rule 7.1.4 c) 6), the organization is required to exclude from the FR measurement units that have been taken out of service. This is important to keep the FR calculations as accurate as possible. Since decommissioned products most often occur in the LTR segment of the populations, the following example shows how to account for the impact on LTR. The same methodology would apply to any of the FR measures.

Using the data from the earlier LTR example, let's suppose that a customer has notified the organization that it is replacing an older product with the latest generation equipment. As of January 2017, 3000 units shipped prior to eighteen months ago have been removed from the field and decommissioned. In January 2017 there were also three earlier returns from this population that had been received in the month. The LTR data for the month would then need to be adjusted to reflect these quantities as shown in the table and calculation below.

**Table 7.5-1 LTR Data for January 2017**

	LTR – Shipped	LTR – Decommissioned	Total – In Field
Returns	39	3	36
Population	30,000	3,000	27,000

## Field Return (FR) Examples

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$$\begin{aligned} \text{Long-Term} & \quad \text{Returns from shipments prior to Jul-15} \\ \text{Return} & = 100 \times 12 \times \frac{\quad}{\quad} \\ \text{Rate} & \quad \text{Total Shipments prior to Jul-15} \\ & = 100 \times 12 \times \text{FRt/FRst} \\ & = 100 \times 12 \times 36/27000 \\ & = 1.33\% \end{aligned}$$